

# Popular Science

FOUNDED

MONTHLY 1872

RADIO SECTION

PAGE 74

*How you can replace  
"B" batteries with  
alternating current.*

*An easy way to add  
a radio-frequency  
amplifier to your set.*



## Amazing plane its own parachute

APRIL

See page 30

25 CENTS

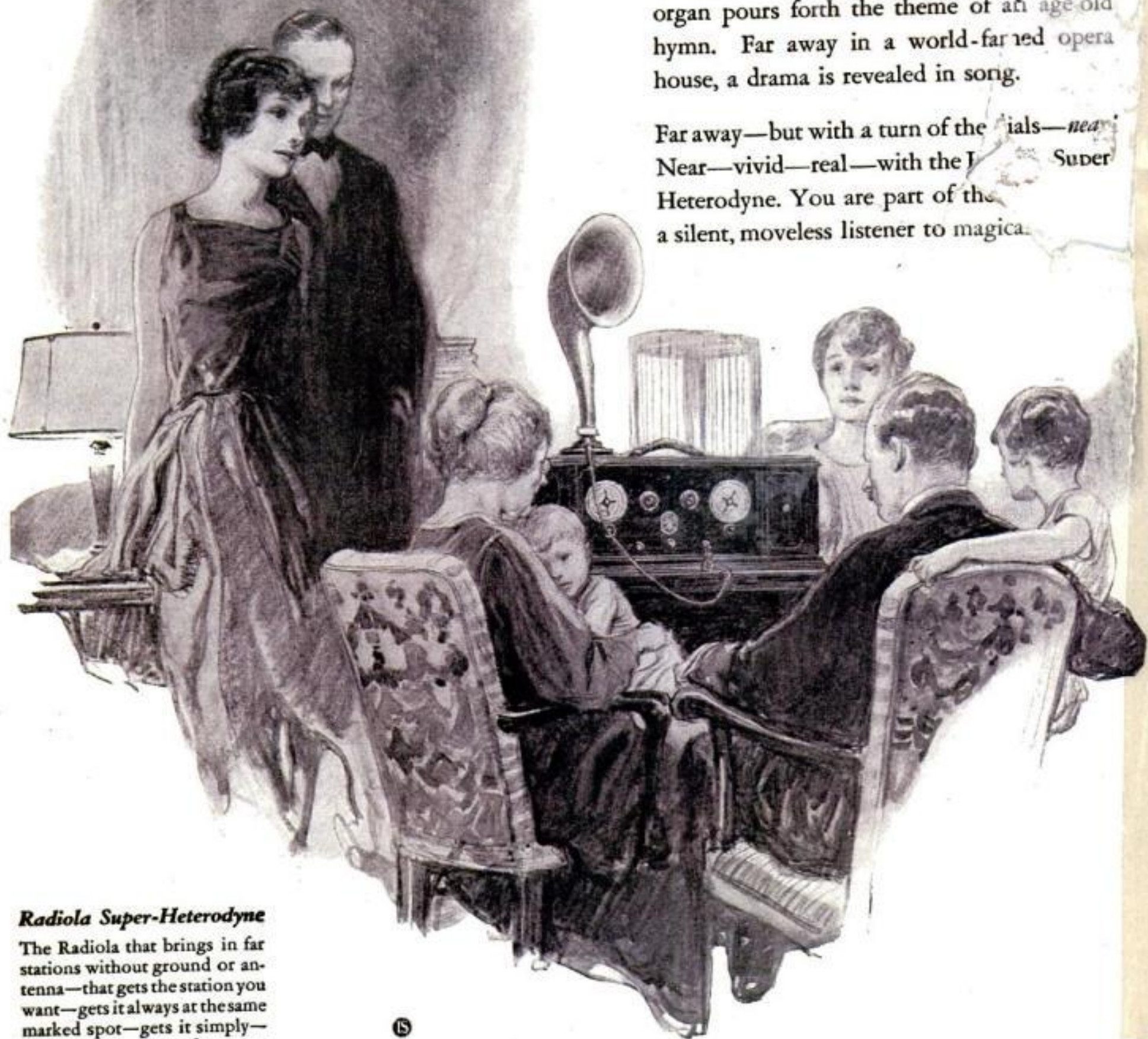
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# Music—

Far away in a spacious hall, a great orchestra unrolls the rich melody-pattern of a master symphony. Far away in a vast cathedral an organ pours forth the theme of an age-old hymn. Far away in a world-famed opera house, a drama is revealed in song.

Far away—but with a turn of the dials—near! Near—vivid—real—with the J. V. Super Heterodyne. You are part of the magic, a silent, moveless listener to magical music.



## **Radiola Super-Heterodyne**

The Radiola that brings in far stations without ground or antenna—that gets the station you want—gets it always at the same marked spot—gets it simply—clearly! Its tone is as famous as its performance.

®

*"There's a Radiola for every purse"*

This symbol  
of quality



is your  
protection

RADIO CORPORATION  
OF AMERICA

Sales Offices:

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10 So. La Salle St., Chicago, Ill.  
28 Geary St., San Francisco, Cal.

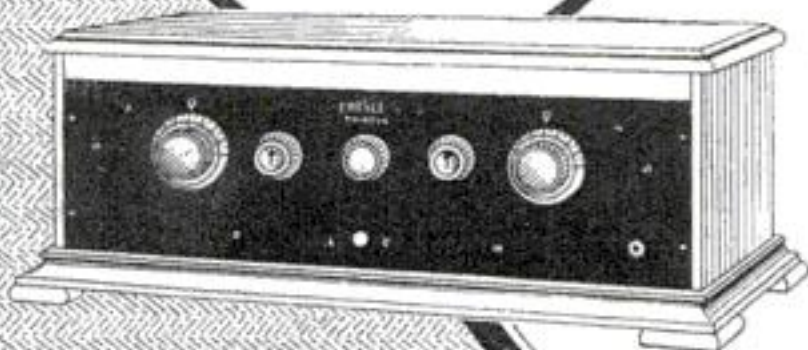
# Radiola

REG. U. S. PAT. OFF.

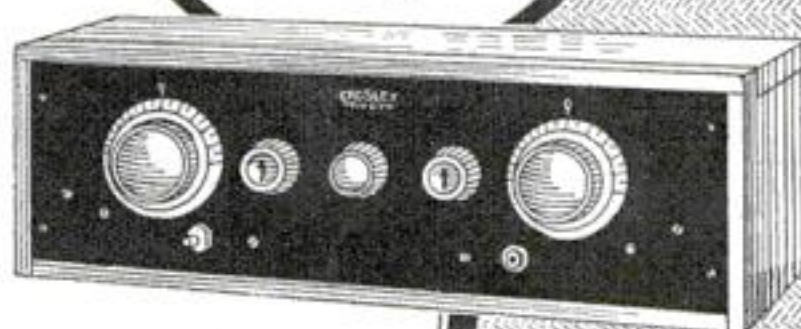


# CROSLEY TRIRDYNS

*Special*  
\$60  
*Formerly \$75*



*Regular*  
\$50  
*Formerly \$65*



*Three Tubes  
Do the work of  
Five or Six  
in the  
Trirdyn*

The recognized outstanding achievement in radio is the Crosley Trirdyn. An overburdening amount of evidence proves that it is excelled by none and superior to most receivers costing many times more. It is a three tube radio combining one stage of tuned radio frequency, regenerative detector and reflex amplification. This combination enables three tubes to do the work of five or six. Brings in every large station in the country on the loud speaker. Is very selective, easy to tune and eco-

nomical to operate. The straight front Trirdyn Regular, formerly \$65; now \$50. The Trirdyn Special in large cabinet to house dry cell batteries formerly \$75; now \$60. To these have been added the new Trirdyn Regular with sloping panel at \$55 and the new Trirdyn Special in a beautiful cabinet with sloping panel at \$65. Demand a Crosley Trirdyn at any good dealer. All Crosley radios are licensed under Armstrong Regenerative U. S. Patent 1,113,149. Write for catalog.

*Prices West of Rockies—add 10%*

**THE CROSLEY RADIO CORPORATION**

Powel Crosley Jr., President

417 Sassafras Street

Cincinnati, Ohio

Crosley Owns and Operates Broadcasting Station WLW





# Popular Science Monthly

Most Wonderfully Illustrated Magazine in the World

APRIL, 1925; Vol. 106, No. 4

25 cents a Copy; \$2.50 a Year



Published in New York City at  
250 Fourth Avenue

## Coming Next Month

**New wonders in store**—Amazing strides in the transmission of pictures by wire and radio during the last year indicate that we are on the threshold of tremendous new discovery. What will it be? Shall we be able to see and talk with distant friends as easily as we now listen to broadcast entertainment? Don't miss this fascinating story of television.

**Commuting by aero-car**—How French inventors plan to relieve congestion of suburban traffic in Paris by an ingenious propeller-driven car speeding 60 miles an hour on rails high above streets and houses.

**Cross country with the air mail**—Thrilling experiences of aerial postmen who, day after day, bridge the distance between New York and San Francisco. An inside story of the world's most remarkable postal system.

**Are you a radio beginner?**—If so, you won't want to miss an article by Alfred P. Lane next month telling how to build a simple but highly efficient one-tube set.

Paul P. Scott, intrepid air-mail pilot, whose recent miraculous escape from death near Salt Lake City will be described next month



And more than 200 other fascinating articles and pictures, giving you all the news of radio and engineering, science and invention, strange and unusual things people are doing, together with practical ideas for the automobile, the home, the home workshop, and the use of tools and machinery.

## POPULAR SCIENCE MONTHLY

Issued monthly. Single copy, 25 cents. Yearly subscription to United States, its possessions, and Canada, \$2.50; foreign countries, \$3. Entered as second-class matter Dec. 28, 1918, at the Post Office at New York under the act of March 3, 1879. Entered as second-class matter at the Post Office Department, Canada. Printed in U. S. A. Copyright, 1925, by the Popular Science Publishing Co., Inc. The contents of this magazine must not be reprinted without permission. In presenting in its editorial columns numerous stories of new products of applied science, POPULAR SCIENCE MONTHLY does not underwrite the business methods of the individuals or concerns producing them. The use of POPULAR SCIENCE MONTHLY articles, or quotations from them for stock-selling schemes is never authorized. O. B. Capen, President and Treasurer; R. C. Wilson, Vice-President; A. L. Cole, Secretary.

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**\$12,000 a Year!**A. H. Ward,  
Chicago, Ill.

A. H. Ward, Chicago, held a small pay job. Now he averages \$12,000 a year as a salesman. Last month he cleaned up \$1,350 and he stepped into this kind of earnings as a result of reading this book.



# What This Amazing Book Did for These 8 Men

It would be just as easy to tell the same story about thousands of men—but what this book brought these eight men is typical. If you do not get a big salary increase after reading this message you have no one but yourself to blame. This amazing book is

**\$1,000 in 30 Days**

"After ten years in the railway mail service I decided to make a change. My earnings during the past thirty days were more than \$1,000."

W. Hartle,  
Chicago, Illinois.

**First Month \$1,000**

"The very first month I earned \$1,000. I was formerly a farm-hand."

Charles Berry,  
Winterset, Iowa.

**\$524 in 2 Weeks**

"I have never earned more than \$60 a month. Last week I cleared \$306 and this week \$218."

Geo. W. Kearns,  
Oklahoma City.

**City Salesman**

"I want to tell you that the N. S. T. A. helped me to a good selling position with the Shaw-Walker Company."

Wm. W. Johnstone, Jr.,  
S. Minneapolis, Minn.

**\$554.37 in One Week**

"Last week my earnings amounted to \$554.37; this week will go over \$400."

F. Wynn,  
Portland, Ore.

**\$100 a Week in Only 3 Months**

H. D. Miller, of Chicago, made \$100 a month as stenographer in July. In September, 3 months later, he was making \$100 a week as a salesman.

**\$10,000 a Year**

O. H. Malfroot, of Boston, Mass., stepped into a \$10,000 position as a SALES MANAGER—so thorough is this training.

## NOW FREE

It seems such a simple thing—but the eight men on this page who did this simple thing were shown the way to quickly jump from deadly, monotonous routine work and miserable earnings to incomes running anywhere from \$5,000.00 to \$10,000.00 a year.

### They Sent for the Book, "Modern Salesmanship," That You Can Now Get—Free

Possibly it is just as hard for you at this moment to see quick success ahead as it was for A. H. Ward of Chicago. When he was a soldier in France, wondering how he would make a living if he got back home safely, \$10,000 a year seemed a million miles away. But read what happened after he had read the book we want you to send for. Almost overnight, as far as time is concerned, he was making real money. The first year he made \$10,000.00.

There is nothing unusual about Mr. Ward, or about his success. Thousands after reading this book have duplicated what he did—Mr. Ward simply was willing to investigate.

The only question is—do you want to increase your earning power? If so—this book will quickly show you how to do it in an amazingly easy way.

### Success Inside Twenty Weeks

There is no long, drawn-out wait after you have sent for this book before you begin to do as the men on this page did. Within twenty weeks you can be ready to forge ahead. This may sound remarkable—but after seventeen years of intensive investigation the National Demonstration Method has been perfected—and this means you can now step into a selling position in one-fourth the time it formerly took to prepare for this greatest of all money-making professions.

Men in every walk of life have made this change—farmers, mechanics, bookkeepers, ministers—and even physicians and lawyers have found that Salesmanship paid such large rewards and could be learned so quickly by this new method that they preferred

to ignore the years they spent in reading law and studying medicine and have become Master Salesmen.

### Simple as A B C

There is nothing remarkable about the success that men enjoy shortly after they take up this result-securing system of Salesmanship training. For there are certain ways to approach different types of prospects, certain ways to stimulate keen interest—certain ways to overcome objections, batter down prejudice, outwit competition and make the prospect act. Learn these secrets and brilliant success awaits you in the selling field.

### Make This Free Test At Once

You don't need experience or a college education. And if you are not sure of yourself, you can find out at once whether you can make big money as a Star Salesman. Simply send the coupon for this Free Book. Ask yourself the questions it contains. The answers you make will show you definitely whether a big success awaits you in this fascinating field. Then the road is clear before you. This amazing book will be a revelation to you. Send for it at once while this free offer is open.

### NATIONAL SALESMEN'S TRAINING ASSOCIATION

Dept. 15-D

N. S. T. A. Building, CHICAGO, ILL.



National Salesmen's Training Ass'n,  
Dept. 15-D,  
N. S. T. A. Building,  
Chicago, Ill.

Gentlemen: I will accept a copy of "Modern Salesmanship" with the understanding that it is sent me entirely free.

Name.....

Address.....

City..... State.....

Age..... Occupation.....



Tom Plumridge, 34 years in the Auto business, is the World's Greatest Automotive Maintenance Engineer. He has served DOLLS, ROYCE, PACKARD, and PARR. He was Chief Instructor of Rotary Engineers for the U. S. during the war. He has trained more Auto Experts than any other man alive.



**GO TO AUTO SCHOOL AT HOME**

Directing Auto Engineer Plumridge

**I Guarantee you a 50% Raise!**

**Look Here!**

Build a business of your own like this!

They only make 3 million new cars a year, but there are 18 million autos, trucks, buses, taxis, and tractors to KEEP GOING! "Up-Keep" is the big end, the BIG MONEY end of the auto business. Look at the picture! My training prepares you AT HOME in spare time to run or OWN a great "Up-Keep" service station like this. Not as mechanic, but as EXPERT! Not doing the jobs, but knowing how and bossing them!

**Start at \$60**  
**Climb to \$200 a Week!**

**Read my Guarantee**

If you are now making less than \$40 a week ENROLL for my home auto-training and I GUARANTEE YOU within sixty days after you finish, a position at 50% more pay or I will refund every cent of your money.



**Has Own Garage**

Clifford J. Coon, Smithville, Ont., opened his own garage, and reports tremendously profitable business.



**Salary Doubled**

R.R. Crews, Marion, Va., only finished the eighth grade in school. My training doubled his salary in five months.



**Owens Business**

Carl F. High, Madison, Wis., owns prosperous Auto-Electrical concern. Does big business over large territory.

Millions of auto owners, corporations with truck or freight-transport fleets, won't put up with the blundering "practical experience" mechanic when they can get instant, guaranteed, trained service from an EXPERT. This idea of Expert "maintenance" service is NEW—it's growing—it is becoming a 5 BILLION DOLLAR A YEAR industry. That's the kind of business to go into, where there's almost NO LIMIT to the money you can make, where there are thousands of big-pay jobs waiting for Experts, and hundreds of opportunities to go into business with little capital. Common schooling all you need.

### This is my idea of an Auto Expert:

Yes, you've got to know all about the mechanical and electrical "up-keep" of autos, but you must know more to go after the BIG MONEY. You must know the business end, most of all. And so I train you in Garage management, Automotive Advertising and Selling, Shop Practice; how to get business and take care of it, how to build good-will, etc. AMERICAN SCHOOL has been noted for business home-training for 28 years. You can't get better anywhere else. So you see I'm not talking about a mechanic's job at \$30 a week. My training makes you an all-round EXPERT—the Expert who owns or manages the whole business, who bosses the mechanics, the Expert who KNOWS autos, trucks, buses, taxis, tractors like A. B. C.

### Let's talk this over!

Look into this opportunity. What I tell you here is only a small part. The rest is in my 36-page book THE WAY TO BIGGER PAY. Find out ALL about the "Up-keep" end of the Auto business. Find out ALL about my "JOB-METHOD" home-training. Find out what my 50% raise guarantee means to you in dollars and cents. Find out what a fascinating, BIG MONEY opportunity Auto "Maintenance" offers. Coupon Brings My Complete Offers—mail it today!

### Raises, Extra Money for STUDENTS

My "JOB-METHOD" combines home-training, actual experience, and money-making in a new way. Students engaged in auto work only part way thru my course report frequent raises. Others say they earn as much in an evening as a whole month's tuition costs. So don't let lack of money (or anything else) keep you from getting my training. You, too, can make this training pay for itself, and then some!

Here is your Coupon!

**I WANT TO BE AN AUTO EXPERT**

TOM PLUMRIDGE, Directing Auto Engineer  
AMERICAN SCHOOL, Dept. A-475,  
Drexel Ave. and 58th St., CHICAGO

Send me QUICK please, your 36-page book THE WAY TO BIGGER PAY and complete information about the "up-keep" end of the Auto business, about your "JOB-METHOD" home-training, and about your 50% raise guarantee.

Name \_\_\_\_\_  
St. No. \_\_\_\_\_  
City \_\_\_\_\_  
State \_\_\_\_\_

TOM PLUMRIDGE, Directing Auto Engineer,  
**AMERICAN SCHOOL**, Dept. A-475, Drexel Ave.  
and 58th St., CHICAGO



## \$500<sup>00</sup> in one Month for Drawing

Careful, conscientious training by members of our faculty made this possible. Today, trained illustrators who draw pictures for magazines, newspapers, etc., both men and women—

**Earn \$200 to \$500 a month and more**

The present splendid opportunities in this field have never been excelled. Thousands of publishers buy millions of dollars' worth of illustrations every year. Illustrating is the highest type of art. If you like to draw, let your talent make your fortune. Develop it. It takes practice, but so does anything worth while. Learning to illustrate is fascinating to anyone who likes to draw.

### The Federal Course is a proven Result Getter THE FEDERAL AUTHORS

include such nationally known artists as Sid Smith, Neysa McMein, Fontaine Fox, Charles Livingston Bull, Clare Briggs and over fifty others. Exclusive, original lessons especially prepared by these famous artists are included in the Federal Home Study Course.

### SEND TODAY FOR "A ROAD TO BIGGER THINGS"

Every young man and woman with a liking for drawing should read this free book before deciding on their life's work. It is illustrated and tells all about illustrating as a profession and about the famous artists who have helped build the Federal Course. It also shows remarkable work by Federal students. Just write your name, age, occupation and address on the margin, mail it to us with six cents in stamps, and we will send you a copy of the book free. Do it right now, while you're thinking about it.

## Federal School of Illustrating

414 Federal School Bldg. Minneapolis, Minn.

### Wrestling Book FREE

Learn to be an expert wrestler. Know scientific wrestling, self-defense, and jiu-jitsu. Develop a splendid physique, and have perfect health. Join this popular school and learn by mail. The famous world's champions—the marvelous Frank Gotch and Farmer Burns offer you a wonderful opportunity. Wrestling is easily and quickly learned at home by mail. Men and boys write now for splendid free book. Learn all the science and tricks. Be able to handle big men with ease. Accept this wonderful offer NOW. Send for free book today, stating your age.

Farmer Burns School of Wrestling, 1734 Range Bldg., Omaha, Nebr.

**A FILE** **Stop Forgetting** **NOT A FILE**

Make Your Mind an Index from which you select facts, figures, names, faces. Develop concentration, self-control; overcome bashfulness, forgetfulness. Write today for FREE memory and concentration test and illustrated booklet, "How to Remember."

**PROF. HENRY DICKSON**  
Dept. 929, Evanston, Ill.



# Do You Want to Make Big Money?



**\$3500 to \$100000 a Year  
is Easy to Earn in  
ELECTRICITY!!**

**Be a  
Cooke Trained  
Electrical  
Expert**

## READ the Proof from My Students

### \$30 to \$56 a Day in Business for Himself



J. R. Morgan, 36 Prescott St., Columbus, O., formerly a \$4.50 a day mechanic, now averages over \$40 a day doing electrical work on his own hook.

### Earns \$800 in 23 Days

Earl R. Montrose, Mono Lake, Calif., gets electrical contract, completes it in 23 days and collects \$800 profit.



### \$7,000 a Year From Electricity on the Farm



Herbert Dickerson used to earn \$30 a week. Now superintendent of Electrical equipment at North Wales Farm, Warrenton, Va., at \$7,000 a year.

### Makes \$750 in Spare Time

Before completing course, John J. Burke, 3332 East Baltimore St., Baltimore, Md., made \$750 doing odd electrical jobs in spare time. Now runs his own big business.



**These are Just a Few  
of Hundreds!**

Hundreds of my students are earning this big money holding down big electrical jobs and in business for themselves. You can do it, too. My 16 big guarantees of satisfaction guarantee your success. Never before was there such a demand for electricity and so many trained men to handle it as there is now. \$75 a week is just an ordinary salary. \$100 a week and even \$200 is easy when you are properly trained—trained as I will train you right in your own home. Step out of your small-pay, no-future job. Be a "Cooke" Trained Electrical Expert, for "Cooke" Trained men get the big jobs in Electricity.

## Big Jobs Open to You

In Radio Work, Power Plants, Contracting, Automotive Electricity—everywhere. The biggest jobs are open to "Cooke" trained men. My employment bureau sees to that. I am actually spending over \$25,000 a year just to get jobs for my students.

## I Can Train You Better

Being a college trained engineer with 25 years of practical experience, and now Chief Engineer of the great Chicago Engineering Works, a Million Dollar Institution, I know exactly what kind of training you need to succeed in this big profession. That's what I give you—practical training by a practical man—the kind of training big electrical companies are looking for and are willing to pay for—the kind of training you will need to be successful in business for yourself.

## Start Earning Money at Once

You can turn my training into money quickly—begin with your seventh lesson. I give you FREE a whole outfit of tools and electrical apparatus and show you how to get and how to do spare time jobs. You make several times the monthly payments for my Course, and get real, valuable, practical experience. "Cooke" training pays its own way.

**L. L. COOKE, Chief Engineer  
Chicago Engineering Works  
Dept. 34, 2150 Lawrence Ave., Chicago**

## My 16 Big Guarantees

I give you 16 definite guarantees when you enroll for my Course, including a signed bond to return

every penny you pay me if you are not satisfied. These guarantees cover FREE Consultation and Employment Service, FREE tools, FREE use of laboratory, FREE Engineering Magazine and other things previously unheard of in home study training. I spare no expense to make you a big and quick success.

## Use My Money to Go Into Business for Yourself

Every month I start two of my students in business for themselves. I give them all the money they need, help them get started and help them to a big success. Get the details of this great offer from my big FREE book.

## Investigate — Get Proof — Big Electrical Book FREE!

You want proof! You want facts! These I give you in my big book—"The Vital Facts About Electricity"—proof that opportunities more wonderful than you ever dreamed of await you—proof that "Cooke" Trained Men do get the big jobs in Electricity and that I can do more for you than anyone else. Send for my new book now. Be a "Cooke" Trained Electrical Expert—Earn \$70 to \$200 a week. Mail the coupon NOW!

## Part of Big Free Outfit



**Mail  
this  
Coupon  
for my  
FREE  
BOOK**

L. L. COOKE, Chief  
Engineer, Chicago  
Engineering Works,  
Dept. 34  
2150 Lawrence Avenue,  
Chicago, U. S. A.

Send me your book, "The Vital Facts About Electricity," full particulars of your Home Study Course, and your sixteen guarantees, including your plan for putting students in business. This does not obligate me to enroll for your Course.

Name.....

Address.....

City..... State.....

**The "COOKE" Trained Man is the "Big Pay" Man!**





## How I Earn \$100.00 a Week as a Radio Expert

**A** YEAR ago I was mightily blue and discouraged. It seemed to me that I would never be more than a low-paid bank clerk. Of course I had a small increase in salary every now and then, but I knew that pretty soon I would reach my limit and there would be no further advancement for me. What future had I to look forward to? Where would I be in five years? I became restless and discouraged and began to look around for some other opportunities.

It was then that I discovered that the demand is for **trained** men, that the opportunities are all for men who can do some one thing better than anything else. There were wonderful opportunities for men who were experts or specialists—but I was ..... a clerk. How I regretted then that I hadn't prepared myself for some definite career!

### I Wanted to Marry

The thing that made me more restless at that time than anything else was the fact that Marian and I were—that is we wanted to be married. But we both knew that we couldn't possibly get along on my salary. If only there was something I could do that would bring me a larger salary!

It was just about the time that every one became so interested in radio. Our whole town became radio-mad, and of course what was happening in our town was happening all over the country—all over the world. I managed to save up enough to buy a receiving set and I was never quite so happy as when I was trying to tune in on stations.

The thing fascinated me. Playing with air waves! Bringing melodies and messages out of the sky! I was never so interested in anything before.

Marian was the first to sense the great opportunity: "Why don't you become a radio expert?" she said. "You like it, and I am sure there must be a big demand for men who understand it. It's a new field and there's plenty of room for wide-awake men."

"But—but I'm not trained!" The thought excited me. To be a radio expert! To find my future in this fascinating new field! "I don't know anything about it, Marian," I said. "I wish I did, though."

"Well, why don't you find out about it?" she retorted. "You can't learn about radio just by listening in to the concerts. Why don't you take a course?"

But we found out that most courses were expensive or that they would interfere with my other work. We were about discouraged

when I discovered that through the National Radio Institute it is possible to become a radio expert by studying right at home in spare time. I told Marian about it and she was elated. "Send off for information at once—today!" she exclaimed.

### Advances Quickly to \$100 a Week

I did, and the following day received an attractive booklet, "Rich Rewards in Radio" telling all about radio opportunities and how to become an expert in any particular phase of the work.

Here was my opportunity at last!

I began to study in all my spare time. It was the most interesting and absorbing study I had ever made. The secret of the radio revealed to me! Day by day I became more skilled and deft until I was able to take apart receiving sets and put them together again as though I were playing with a toy. It was fun! In a month I was able to take a position as lineman at a bigger salary than I was getting at the bank. This was wonderful experience for me, and I kept right on with my studies. It wasn't long before I qualified for a position as radio engineer at a salary of \$100.00 a week! That is what I am earning now, though I expect to make more soon. It seems to me almost too good to be true, after all those years as a low-paid clerk in a bank. And Marian, who will soon be my bride, keeps saying, "I told you so!"

As a radio expert I can tell you that there is a tremendous demand for men who can build, sell and install radio sets, who can design, test, repair. Men are needed as operators, engineers and executives, all over the world. The opportunities are limitless, and if you like radio there is no reason why you cannot qualify for one of these positions by studying in your spare time at home as I did.

The National Radio Institute offers an absolutely complete course which prepares you for the Government First Class Commercial License and for the bigger-paying jobs in Radio. The Director, E. R. Haas, will be glad to send you all details of their marvelous new method of practical instruction, including information concerning the Free Employment Service which secures positions for National Radio Institute graduates. Everyone interested should have this information. **It's free**, and this coupon will bring it to you. I advise you to send it off today. Radio is a new and interesting field, and it offers you more money than you probably ever dreamed possible.

### Important

Those who mail the coupon **at once** will also receive details of Special Short Time Reduced Rate. Do it now.

**National Radio Institute, Dept. 12-FB,  
Washington, D. C.**

I am interested in radio and would like to find out whether or not I am suited for a radio career. Please send me, without the slightest obligation, your interesting free book called "Rich Rewards in Radio." Also full details concerning your special Short Time offer.

Name.....

Address.....

City..... State.....

**FREE Vocational Test**  
Chicago Technical College  
Dept. 431 118 East 26th Street, Chicago, Ill.  
Gentlemen: Send me, without cost or obligation,  
your Free Vocational Test Lesson and your 40-  
page Booklet of Facts About Drafting.

Name..... State.....  
Address.....  
City.....

**Offered  
by a famous  
College of Engineering**

Here is an opportunity to prove your fitness and liking for one of Industry's highest-paid professions. Vocational guidance of the highest order—a free test lesson in Drafting.

## DRAFTING

### Short HOME STUDY Course

A Free Trial Home Study Lesson sent you without obligation. Before you enroll we want you to know what drafting is like... how we teach by mail... and whether you will like this fascinating, well-paid profession.

### 40-page Book of Facts, FREE

Tells you all about drafting and our short, intensive drafting courses. What prominent men say... where draftsmen are employed... their salaries... their opportunities... how... and why... many of our students have increased their salaries even before finishing their courses.



Chicago Technical College, founded in 1904, is "America's Oldest and Largest School of Specialized Engineering." It offers to resident students 2-year and 3-year courses in Architecture and Engineering, leading to diplomas and B.S. degrees. Short courses, also, in Drafting, Plan Reading, Estimating, Building Construction, etc. Over 1000 men enrolled each year in day and evening classes. 50% of them accept part-time positions before graduation. 90% of them get positions immediately upon graduation.

### Opportunities in Chicago to Earn while you Learn

For those who can come to Chicago, there is a splendid opportunity to learn Drafting, Engineering or Architecture at the College while earning expenses in part-time positions. If interested, write for 52-page Blue Book of Resident Courses.

### \$35 to \$100 per Week

Everything today... from skyscrapers to turbine engines... is built from drawings made by draftsmen. The American Bridge Co. alone, employs 600 to 750 draftsmen. The draftsman works hand in hand with the engineer, the architect, the builder. The better-trained men rise quickly from positions paying \$35 to \$50 per week to \$300, \$400 and \$500 per month and more.

We have been teaching Drafting for 21 years. Thousands of our graduates are in high salary positions, today. We train you in 10 months or less. No special preparation or talent required.

Tuition low; payments easy. Professional outfit included, or credit will be allowed if you have instruments.

### Mail Coupon Now

Today, find out what Drafting may mean to you as your life work. We have made the test easy, for, with no obligation, we send you a Vocational Test Lesson free. Clip coupon at the top of this ad. Mail now.

**Chicago TECHNICAL College**  
Dept. 431, 118 East 26th Street, Chicago

**Prizes**  
for Boys & Girls

Send fifteen cents for the fascinating, entertaining, **GRANDDADY** prize-winning **CROSS-WORD Puzzle Book** and how to win Red Injun bicycles, radio sets, wrist watches, cameras, rifles, rings, fountain pens, skates, knives and many other big prizes.

Book contains 5 of our famous Chicago Daily News contest prize-winning puzzles and many others.

**LANGDON SPECIALTIES CO.**  
Department F SAINT PAUL, MINN.





In Twelve  
Weeks

Not by Correspondence  
All PRACTICAL Work at

COYNE

In Great  
Shops!

Coyne trained Electrical Experts are in demand everywhere—because they are men who are *practically* trained and *thoroughly* trained for the Big Jobs in Electricity. Send that coupon to me now and see how I fit you for one of the thousands of BIG PAY OPPORTUNITIES in 12 short weeks! No obligation at all! Act quick!

Earn \$60 to \$200 a Week!

Clip that Coupon Right Now! Get my Big New Book—IT'S FREE! It points the way to Success for you. Crammed full of hard, dependable, proven Facts. Shows the way to Big Pay in the Largest, Most Interesting Money-Making Field—ELECTRICITY! Find out how a world of Opportunities can be opened up for you as a Coyne-Trained Electrical Expert. See what my PRACTICAL TRAINING has done for others. Read what they say about Coyne.

I'll Make You An Electrical Expert  
IN 12 WEEKS!

Yes, sir, I train you for the BIG JOBS in ELECTRICITY! Coyne IS NOT A CORRESPONDENCE SCHOOL! I train you—*thoroughly*—on thousands of dollars' worth of Electrical Apparatus. You do ACTUAL WORK on REAL EQUIPMENT—the kind you use out on the job. That's why my students MAKE GOOD. That's why you Master Electricity in 12 WEEKS at Coyne!

**Coyne Trains You For Life** It makes no difference how little Education or Electrical Experience you have had, I'll make you an Electrical Expert through Coyne's LEARN-BY-DOING METHODS! I have done it for thousands. I will do it for YOU! At Coyne you get a Life Scholarship. You can stay longer than the required time if necessary. You can return any time later to take up new work I am continually adding to keep my course up-to-date at all times.

You Learn in Chicago  
the Electrical Center  
of the World

Coyne students master Electricity right in the Electrical Center of the World. You see everything electrical here. Along with my Shop Training you visit the big organizations and power plants—learn their methods first hand.

Earn While You Learn

I back my students up. My Employment Dept. will assist you in getting a part time job to make a good part of your expenses while training. And it will help you get a BIG PAY JOB on graduating.

26 Years of Success

Remember Coyne is a School with an established REPUTATION. Endorsed by Electrical Industry. Over a QUARTER OF A CENTURY of Success that was earned by the BIG SUCCESSES of Coyne Students. You owe it to yourself to find out what I can do for you. Clip the Coupon Now!

H. C. LEWIS, President.

NOW!  
Radio  
& Auto  
Course  
FREE

Special Offer right now! I am including *Absolutely Free* my Big New RADIO COURSE and AUTO, TRUCK and TRACTOR ELECTRICITY.

Coupon brings full details.

Send for it now. It's a book worth having. Handsomely bound. Beautifully Illustrated. Size 12x15 inches. Shows dozens of actual photographs of Coyne students working in my BIG SHOPS. Gives others' experiences. Shows what you can do. Cost me a dollar, but it's yours free if you mail coupon. Do it now!

MAIL THIS COUPON

H. C. LEWIS, President  
COYNE ELECTRICAL SCHOOL,  
1300-10 W. Harrison St., Dept. 136-4 CHICAGO, ILLINOIS

Dear "H. C.":—Please send me, *absolutely FREE*, your big New Book and full particulars of your Special Offer of Two Extra Courses *FREE*.

Name .....

Address .....

H. C. LEWIS  
President

COYNE  
ELECTRICAL SCHOOL

FOUNDED  
1899

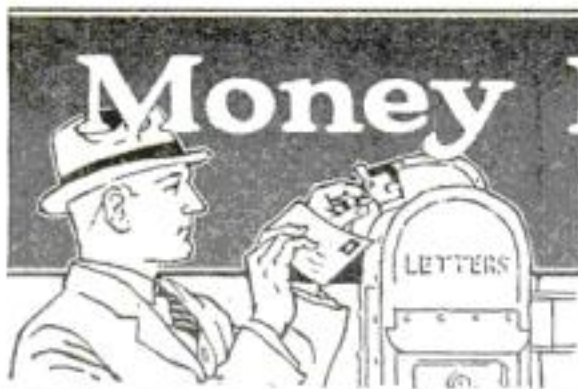
Dept. 136-4

1300-1310 W. Harrison Street

CHICAGO, ILL.

Copyrighted material





### AUTOMOBILES AND ACCESSORIES

**MONEY!**—Silvering autolights, radiators, mirrors. Refinishing tableware, stoves, brass beds, etc. Outfits. Methods free. Write—Sprinkle-Plater, Dept. 96, Marion, Indiana.

**AUTOISTS.** Know whether your Headlights are lighted. Our "IS-IT-LIT" Telltales for \$1.25 are positive indicators. If out of gas on the road our Gas Siphon Pump will enable you to borrow from the first passing car and get home; price \$2.50. Handy Specialty Co., Somerville, Mass.

### FORD ACCESSORIES

**CALIFORNIA** Tops for Ford Roadster and Touring. Stylish—Noiseless. Cool in Summer. Warm in Winter. Easily installed. High quality. Low prices. Write factory today. Koupet Auto Top Company, Belleville, Ill.

### MOTORCYCLES, BICYCLES, SUPPLIES

**OVERSTOCKED**—200 Used Motorcycles. Must be sold at once. We have Harley-Davidsons, Indians, Hendersons, Excelsiors, Cleveland. Prices \$25.00 up. Write for our Bargain List. Myerow Brothers, Dept. C, 15 Berkeley St., Boston, Mass.

**DON'T** buy a bicycle motor attachment until you get our catalogue and prices. Shaw Mfg. Co., Dept. 4, Galesburg, Kansas.

### MODELS AND MODEL SUPPLIES

We make working models for inventors and experimental work, and carry a complete stock of brass gears and model supplies. Send for catalogue. The Pierce Model Works, Tinley Park, Illinois.

**HULT & Co.**, 625 Jackson, Chicago, Ill. Experimental Machinists. Model Makers. Dies. Patterns. Complete general Machine shop. Ex-Lamson.

**MR. ADVERTISER:** Ask today for a copy of the "Quick-Action Advertising Rate Folder." It contains some really important facts which will prove interesting and valuable to you. It also tells "How You Can Use Popular Science Monthly Profitably." You'd like to know, wouldn't you? Address your inquiry to: Manager, Classified Advertising, Popular Science Monthly, 250 Fourth Ave., New York.

### MOTORS, ENGINES AND MACHINERY

**MOTORS**—Manufacturer's Surplus Sale. 1/4 HP. \$8.50; 1/2 HP. \$32.50; 1 HP. \$54.50. 8 Volt Charging Generators, \$8.50. Complete Lighting Plants—Generators—Light Machinery. Write for Catalog. Motor Specialties Co., Crafton, Penna.

**NEW** General Electric 1/2 Horse 110-220 Volt Alternating Motors, \$29.50. 25% with order. Also other sizes. Generators, etc. Queen City Electric Co., 1740 Grand Av., Chicago, Ill.

**ENGINES**—\$5 per horsepower. Auto engines make excellent Power Plants. We make the Governors, etc. P. S. Smith Governor Co., Springfield, N. Y.

**MOTORS**, \$2.98, Good, Practical, twentieth horsepower, 115 volt alternating direct current. Order Now. Pay Postman. Perry Trading Co., Dept. 84, 815 Lake, Racine, Wis.

**CONCRETE** Building Block Machines and Molds. Catalogue free. Concrete Manufacturing Co., 307 So. Third St., St. Louis, Mo.

### MANUFACTURING

**DIES**, Tools and General Manufacturing. Models and manufacturing of new inventions our specialty. Logan Machine Co., 126 S. Clinton St., Chicago, Ill.

**PATTERNS**, wood and metal. Models, tools and dies. Brass, bronze, aluminum and iron castings. Screw machine work, production work of all kinds. Write Modern Machine & Pattern Co., Terre Haute, Ind.

### MACHINE TOOLS

1 12"x6" Leblond Lathe quick change, \$210.00. 12"x6" Reed engine lathe, \$145.00. Number 60 Hand cylinder grinder \$700.00. 1 14" Shaper, \$185.00 complete line machinery. Cincinnati Machinery Supply Co., 217 E. Pearl St., Cincinnati, Ohio.

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### AVIATION

The American School of Aviation announces a new correspondence course in mechanics of aviation. A thorough training in practical aeronautics. American School of Aviation. Dept. 6741, 3601 Michigan, Ave., Chicago, Illinois.

**LEARN to Fly!** We have an opportunity for you. Write for details. Varney Aircraft Co., Peoria, Ill.

### FOR THE HOME

**HOME** Weaving—Looms only \$9.90. Big money in weaving Colonial rugs, carpets, etc., from rags and waste material. Weavers are rushed with orders. Send for Free Loom Book. It tells all about home weaving and quotes reduced prices and easy terms on our wonderful new looms. Union Loom Works, 482 Factory St., Boonville, N. Y.

**GRANDFATHER** clock works \$5.00. Build your own case, instructions free; make good profits selling your friends. Clock works with chimes for old or new cases. Write for full particulars. Clock Co., Nicetown, Penn.

**MR. ADVERTISER:** Ask today for a copy of the "Quick-Action Advertising Rate Folder." It contains some really important facts which will prove interesting and valuable to you. It also tells "How You Can Use Popular Science Monthly Profitably." You'd like to know, wouldn't you? Address your inquiry to: Manager, Classified Advertising, Popular Science Monthly, 250 Fourth Avenue, New York.

## Another \$25.00 IN PRIZES

To win one of these cash prizes is easy, and every reader is invited to enter this fascinating competition. Just write a letter of not over seventy words answering this question:—

**What Advertisement of "Money Making Opportunities" in this issue interests you most and why?**

Here are the prizes we will pay for the ten best letters answering the above question:—

First Prize . . . . . \$10.00  
Second Prize . . . . . 5.00  
Third Prize . . . . . 3.00  
And 7 Prizes  
of \$1.00 each . . . . . 7.00

First read every one of the "Money Making Opportunities" advertisements on pages 8 to 21. Check the ones that interest you. Then read over the ones you have checked and decide on the one that interests you most.

Then write a short letter, not more than seventy words, telling us why the advertisement you pick interests you most. Remember that ten prizes will be awarded. You have a good chance of winning one of them. Be sure to mail us your answer before April 1st. The prizes will be awarded, in the order of their merit, for the letters that are most interesting and best expressed.

The names of all the prize winners and the letters that win the first two prizes will be printed in this column in the June issue. Address your prize letter to

Contest Editor

POPULAR SCIENCE MONTHLY  
250 Fourth Ave., New York City

### Last Month's Prize Winners

The First Prize of \$10.00 goes to M. T. Wray, Indianapolis, Ind., for his letter on the advertisements of The Logan Machine Co., Victor J. Evans & Co., and Western Security Co. Here is Mr. Wray's letter—

Contest Editor:

The Money Making Opportunities columns have introduced to me a trio of advertisers whom I am satisfied will prove profitable acquaintances.

The Logan Machine Company built the models of an automobile accessory I devised. Victor J. Evans & Co., have made out the patent application, and the Western Security Company will provide the necessary promotion finances.

Therefore I feel that I have reason to be triply grateful.

Yours very sincerely,  
M. T. WRAY.

Mrs. C. O. Still, of Florence, S. C. wins the Second Prize of \$5.00 for the following letter—

Dear Editor:

The advertisement on Page 31, "Twenty-five dollars in prizes," hit me right in the eye. Tucking it away among others, something on the order of an Easter egg hunt, is very clever of you. I had never read an advertisement until the magazines commenced offering prizes. Now I read them all. As a consequence have used two to good advantage. I believe, both to myself and the advertiser.

Yours very truly,  
MRS. C. O. STILL.

The Third Prize goes to Mr. Robert V. Hill of Glide, Oregon, for his letter on the advertisement of the Mayneda Company.

The winners of the other seven prizes are:—

M. M. Sullivan, Indianapolis Ind., R. M. Benberger, Galion, Ohio, Clifford B. Kritt, New Prague, Minn., Robert C. Thomas, Akron, Ohio, Clarence Bartmas, Butler, Pa., Louis R. Murray, Ogdensburg, N. Y., and Richard E. Harper, Baltimore, Md.

Rate 30 Cents a Word. A 10% discount is allowed on all contracts for six consecutive insertions. Advertisements intended for the June issue should be received by April 5th

### RADIO AND SUPPLIES

**YOUR** Crystal Set will work 400 to 1000 miles if made by my plans. No tubes or batteries. Copyrighted plans \$1.00; or furnished FREE with complete parts for building set, including special coil and panel correctly drilled for only \$5.00. Satisfaction guaranteed or money refunded. Satisfied customers everywhere. Particulars free. Leon Lambert, 555 Kaufman Bldg., Wichita, Kansas.

**RADIO** Generators: 500v 100 watt, \$28.50. Battery Charging Generators, \$8.50. High Speed Motors. Motor Generator Sets all sizes. Motor Specialties Co., Crafton, Penna.

**WONDERFUL** Discovery—build this Radio Apparatus—it's easy; light your home free. Produce Electricity from water and air; book and 30 years' Experience—it's \$1.00 Postpaid. Spark Co., Monongahela, Pa.

**2,650 MILES** Distance with one tube. Any Novice understands our Simplified Instructions, including Panel Layout and Photo 2cc. Vesco Radio Co., Box PS-117, Oakland, Calif.

### EDUCATIONAL AND INSTRUCTION

**USED** correspondence school courses save over half. Bargain catalogue 1000 courses free. Used courses bought. Students' Exchange, Dept. A, 47 West 42d, Street, New York.

**CORRESPONDENCE** Courses sold complete: 1-3 usual prices because slightly used; easy terms; money back guarantee. All schools and subjects. Write for special Free catalog. Courses bought for cash. Economy Educator Service, 202-N. West 49th St., New York.

**HIGH** School, Normal, Business, Law and Collegiate courses thoroughly taught by mail. Typewriting course free. Apply Carnegie College, Rogers, Ohio.

**BOOKKEEPING** in a week, \$2 complete. Dukes, 640 West 153d Street, New York.

**CORRESPONDENCE** Courses—all schools sold complete at lowest prices. Easy terms, money-back guarantee. Courses bought for cash. Catalog Free. Mention Subject. Economy Educator Service, 442-B, Sansome, San Francisco.

**DOUBLE** entry bookkeeping mastered in 60 hours; guaranteed; diploma. International Bookkeeping Institute, Springfield, Missouri, Desk 10.

**EARN** \$25 weekly, spare time, writing for newspapers, magazines. Experience unnecessary. Copyright book free. Press Syndicate, 971, St. Louis, Mo.

**WORLD-ROMIC**, Masterkey. Spanish Primer, \$1.94. Languages, 8 West 40th, New York.

**RAILROAD** Postal Clerks start \$133 month, railroad pass. Send stamps for questions. Columbus Institute, N-2, Columbus, Ohio.

**SHORTHAND**—Easy complete course. Most rapid readable system. First lesson papers and pamphlets for 10c postage. Memorscript Institute, Roanoke, Virginia.

**GET** a Foreman's job. Become an expert blue print reader. Earn more money. My training will give you a bigger pay envelope quick. Send for Free Plan. Tell me what trade you want. Carroll Rumsey, 201 Drexel Bldg., Philadelphia, Pa.

### BOOKS, MAGAZINES, ETC.

**LAFFALOG** is a monthly devoted to Wit and Wisdom Essays, Poems and Formulas. Sample copy 10c. P. S. Lutz Printing Co., York, Penna.

**ENCYCLOPAEDIAS** all kinds, Harvard Classics. About half price. Dalton Riggs, Crilly Bldg., Chicago.

**MR. ADVERTISER:** Ask today for a copy of the "Quick-Action Advertising Rate Folder." It contains some really important facts which will prove interesting and valuable to you. It also tells "How You Can Use Popular Science Monthly Profitably." You'd like to know, wouldn't you? Manager, Classified Advertising, Popular Science Monthly, 250 Fourth Ave., New York.

### SONGWRITERS, AUTHORS AND MANUSCRIPTS

**PHOTOPLAY**—Story Ideas wanted. \$25-\$500 paid. Experience unnecessary; outline Free to anyone. Write Producers League, 312 St. Louis.

**WRITERS**—Stories, poems, plays, etc., are wanted for publication. Literary Bureau, 117, Hannibal, Missouri.

**I WANT** song poems. Casper Nathan, J-1252 Bryn Mawr, Chicago.

**\$55 FOR** ideas. Photoplay plots accepted any form, revised, criticized, copyrighted, marketed. Advice free. Universal Scenario Corporation, 214 Security Bldg., Santa Monica and Western Avenue, Hollywood, California.

### LANGUAGES

**IDEOPHONIC PRIMER**, \$1.94: Chinese, French, Spanish. Languages, 8 West 40th, New York.

### STAMMERING

**ST-TUT-T-T-TERING** and stammering cured at home. Instructive booklet free. Walter McDonnell, 59 Potomac Bank Building, Washington, D. C.

### AMERICAN MADE TOYS AND NOVELTIES

**OPPORTUNITY** to start Manufacturing Metal Toys and Novelties. No experience necessary. Enormous demand exceeds supply. We furnish, at cost, casting forms for production and buy entire output, also place yearly contract orders. Casting forms made to order. Catalog, advice and information free. Metal Cast Products Co., 1696 Boston Road, New York.

**MR. ADVERTISER:** Ask today for a copy of the "Quick-Action Advertising Rate Folder." It contains some really important facts which will prove interesting and valuable to you. It also tells "How You Can Use Popular Science Monthly Profitably." You'd like to know, wouldn't you? Address your inquiry to: Manager, Classified Advertising, Popular Science Monthly, 250 Fourth Avenue, New York.

**More Money Making Opportunities on pages 10 to 21**



# He Doesn't Know It Yet But He's a \$6,000 Man

"DO YOU SEE that earnest-looking fellow talking to the President?" —It was the General Manager speaking; he and his guest were taking a turn thru the main offices.

—"That's the man I've got picked to take Short's place, as Auditor of the Company, when Short goes East. I've had my eye on him for more than a year; he's the kind of fellow who's bound to get ahead. I learned the other day that he has been studying evenings at home for the past six or eight months. He's one of the few men who really seem awake to their opportunities. A fellow like that is too good to lose, and we're going to make it worth his while to stick. He doesn't know it yet, but he's a six-thousand-dollar man!"

\* \* \*

"Studying evenings—working out problems—taking an interest in the business"—if the men in subordinate positions could only read the minds of the men directing them, what surprising things they would learn about themselves!

—How every day, for example, those who show promise are being appraised for bigger jobs. —How their capacity is constantly being measured by the readiness with which they grasp the larger problems of the business. —How they are being gauged by the foresight they show in preparing for greater responsibilities.

For, after all, the extent to which a man is willing to *prepare* for bigger things is a mighty good index to his fitness to *control* them— isn't it?

The boss, you see—if he is a real executive and not a figurehead—put in many years equipping himself for his present position. Is it likely that he will overlook the chap who shows the same habits and tendencies which helped *him* to get ahead?

Then, too, when a man undertakes home-study training, he proves that he has good common-sense—and *that's* an asset!

For consider the logic of his undertaking—

For a comparatively few months—a year or two, at most—a man agrees with himself to give up a certain proportion of his "good times." He weighs them against his ambition to increase his income, and he deliberately chooses the bigger salary, the larger future. He knows that training is what he *needs*, and he values his self-respect so highly that he cannot be happy to drift any longer.



The point to all this is very simple. In making a decision of this kind, he is demonstrating his ability to discriminate between the values that are worth while and those that are no values at all. And inevitably that kind of shrewdness makes a real hit with sound business men.

## He Learns by Solving Problems —and It's a Fascinating Method

But there's another phase to home-study training which we have neglected to mention.

While it takes courage to map out a course for oneself and to make the start, it is only a short time after one has got under way when it becomes no task at all, and instead of regarding his studies as a burden, a man gets to really looking forward to his periods of training. Under

the LaSalle Problem Method, he works with actual business problems, and they fascinate him. He is conscious that he is growing in business power. He sees the results of his increased ability in the promotions that he gains.

Consider, for example, such simple statements as the following, all susceptible to ready proof:

"Salary and earnings have increased over 183 per cent. Your course has given me the position I wished for, the salary I looked for, and has broadened my knowledge and vision so that I have perfect confidence in my ability to do any job in the accounting field."  
FRANK B. TRISCO, Minnesota.

"Instead of a factory storekeeper, I find myself at the end of three years head of a department, with an increase in salary of 230 per cent."

F. H. LAWSON, California.

"Led the list in the Maine bar examination."  
GORDON F. GALLERT, Maine.

"From a salesman in the ranks, in two short months my sales have shot up nearly 150 per cent. I am now a district manager, with eleven men working under me."  
C. RUTHERFORD, Canada.

"—a total of 90 per cent increase in salary in two years. I saw this promotion in advance and was preparing myself for it, altho it came six months sooner than expected, which goes to show that it pays to be prepared."  
R. L. REEVES, Alabama.

## Make Yourself a \$6,000 Man

Of course no amount of WISHING can get a man out of a mediocre place and put him on the right road to success.

But what astounding things a man can do if he changes his wishing to WILLING—if he really sets up a goal for himself and steadily bends his energies toward REACHING it!

What is YOUR goal? Is it symbolized by one or more of the courses listed on the coupon just below?

Then, for the sake of your future, take out your pencil NOW—check the training that appeals to you—sign your name and address—and put it in the mail.

There is, of course, no obligation—but there's a great big OPPORTUNITY—and it's automatically set aside for the man who ACTS.

# LASALLE EXTENSION UNIVERSITY

The World's Largest Business Training Institution

—INQUIRY COUPON—

LASALLE EXTENSION UNIVERSITY

Dept. 483-R

Chicago, Illinois

Please send me catalog and full information regarding the course and service I have marked with an X below.

☐ Business Management: Training for Official, Managerial, Sales and Departmental Executive positions.

☐ Modern Salesmanship: Training for position as Sales Executive, Salesman, Sales Coach or Trainer, Sales Promotion Manager, Manufacturer's Agent, Solicitor, and all positions in retail, wholesale, or specialty selling.

☐ Higher Accountancy: Training for position as Auditor, Comptroller, Certified Public Accountant, Cost Accountant, etc.

☐ Law: Training for Bar; LL. B. Degree.

☐ Commercial Law: Reading, Reference and Consultation Service for Business Men.

☐ Traffic Management—Foreign and Domestic: Training for position as Railroad or Industrial Traffic Manager, Rate Expert, Freight Solicitor, etc.

☐ Railway Station Management: Training for position of Station Accountant, Cashier and Agent, Division Agent, etc.

☐ Banking and Finance: Training for executive positions in Banks and Financial Institutions.

☐ Modern Foremanship and Production Methods: Training for positions in Shop Management, such as that of Superintendent, General Foreman, Foreman, Sub-Foreman, etc.

☐ Industrial Management Efficiency: Training for positions in Works Management, Production Control, Industrial Engineering, etc.

☐ Personnel and Employment Management: Training in the position of Personnel Manager, Industrial Relations Manager, Employment Manager, and positions relating to Employee Service.

☐ Modern Business Correspondence and Practice: Training for position as Sales or Collection Correspondent, Sales Promotion Manager, Mail Sales Manager, Secretary, etc.

☐ Expert Bookkeeping: Training for position as Head Bookkeeper.

☐ Business English: Training for Business Correspondents and Copy Writers.

☐ Commercial Spanish: Training for position as Foreign Correspondent with Spanish-speaking countries.

☐ Effective Speaking: Training in the art of forceful, effective speech, for Ministers, Salesmen, Fraternal Leaders, Politicians, Clubmen, etc.

☐ C. P. A. Coaching for Advanced Accountants.



Name..... Present Position..... Address.....





## See How Easy It Is To Learn Music This New Way

**Y**OU know how easy it is to put letters together and form words, once you have learned the alphabet. Playing a musical instrument is not very much different. Once you learn the notes, playing melodies on the mandolin, piano or violin is simply a matter of putting the notes together correctly. The first note shown above is F. Whether you are singing from notes, playing the piano or banjo or any other musical instrument, that note in the first space is always F. The four notes indicated are F, A, C, E, easy to remember, because they spell the word "face." Certain strings on the mandolin, certain keys on the piano, represent these same notes—and once you learn them, playing melodies on the instrument is largely a matter of following the notes. Anyone can now learn to play a musical instrument at home, without a teacher. A new simplified method of teaching reduces all music to its simplest possible form. You can now master singing, piano-playing, or any musical instrument you wish right at home, quickly, easily, without endless study and practice.

Practice is essential, of course—but it's fun the new way. You'll begin to play melodies almost from the start. The "Print-and-picture" method of self-teaching is fascinating: it's simply a matter of following one interesting step after another. You learn that the note in the first space is F, and that a certain key on the piano is F. Thereafter you will always be able to read F and play it whenever you see it. Just as you are able to recognize the letters that make a word, you will be able to recognize and play the notes that make a melody. It's easy, interesting.

You don't have to know anything whatever about music to learn to play a musical instrument this new way. You don't have to pin yourself down to regular hours, to regular classes. You practice whenever you can, learn as quickly as you please. All the intricate "mysteries" of music have been reduced to a method of amazing simplicity—each step is made as clear as ABC. Thousands have already learned to play their favorite musical instruments this splendid new quick way.

### You Can Play Your Favorite Instrument Three Months from Today

If you are dissatisfied with your present work, let music act as a stepping stone into a new career. If you long for a hobby, a means of self-expression, let music be the new interest in your life. If you wish to be a social favorite, if you wish to gain popularity—choose your favorite instrument and, through the wonderful home-study methods of the U. S. School of Music, play it three months from today.

You can do it. Youngsters of 10 to 12 years have done it, and men as old as 60 have found new interest and enjoyment in learning how to play a musical instrument. You don't have to listen while others entertain any longer. YOU can be the center of attraction, the talented person who holds the audience fascinated.

Is it the piano you wish to play, the mandolin, the violin, the saxophone? Do you want to learn how to sing from notes? Are you eager to be able to play "jazz" on the clarinet, the banjo?

### LEARN TO PLAY ANY INSTRUMENT

Piano	Drums and
Organ	Traps
Violin	Harmony and
Banjo	Composition
Clarinet	Sight Singing
Flute	Ukulele
Harp	Piccolo
Cornet	Trombone
Cello	Guitar
Saxophone	Hawaiian
Mandolin	Steel Guitar
Voice and Speech	Culture
Automatic Finger Control	
Piano Accordion	

### FREE BOOK Explains All—Send Today

Send for our free book called "Music Lessons in Your Own Home." Every one who is interested in music should send at once for this valuable book. It not only explains the wonderful new simplified method of learning music, but tells about a special short-time offer now being made to music-lovers.

With it will be sent an illustrated folder which proves, better than words, how delightfully quick and easy the famous Print-and-Picture Method is. Mail this coupon at once for your copy. Remember it obligates you in no way whatever—it's free. But act now before the supply is exhausted. U. S. SCHOOL OF MUSIC, 84 BRUNSWICK BUILDING, NEW YORK.

(Please write plainly)

U. S. SCHOOL OF MUSIC  
84 Brunswick Building, N. Y. C.

Please send me your free book, "Music Lessons in Your Own Home," with introduction by Dr. Frank Crane, illustrated folder and particulars of your special offer. I am interested in the following course:

Have you above instrument?.....  
Name.....  
Address.....  
City..... State.....

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DELAWARE Incorporator. Charters: Fees Small; forms. Chas. G. Guyer, 901 Orange St., Wilmington, Delaware.

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**More Money Making Opportunities on pages 8 to 21**



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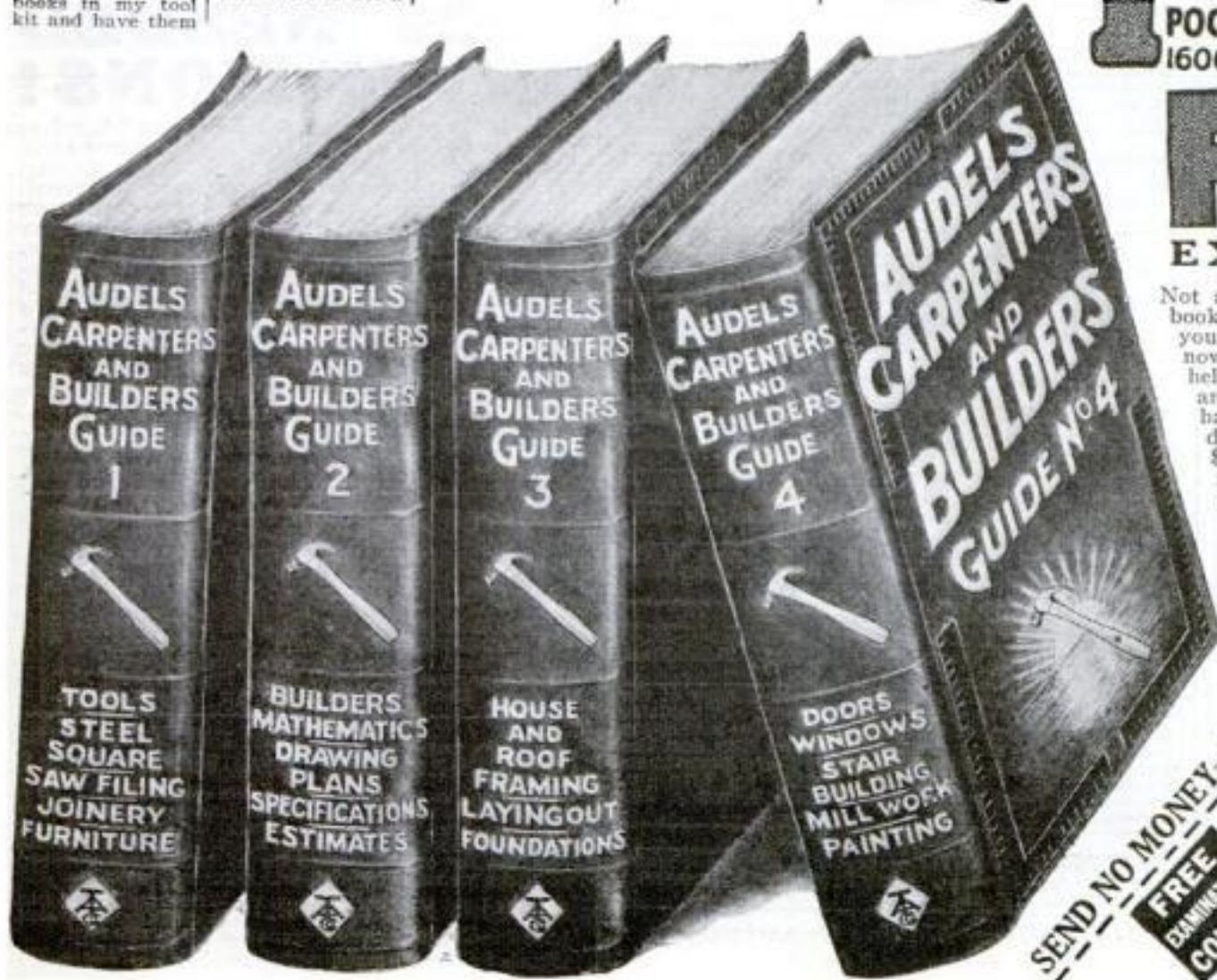
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**More Money Making Opportunities**  
on pages 8 to 21

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**EARN \$10 daily** silvering mirrors, plating and re-finishing metal ware, headlights, chandeliers, bedsteads. Outfits furnished. F. Decle Laboratories, 1133 Broadway, New York.

**WE start you without a dollar.** Soaps, extracts, perfumes, toilet goods. Experience unnecessary. Carnation Co., Dept. 21, St. Louis.

**BRING Home The Bacon—selling Stuart's Stain Remover.** Removes ink, iron rust, grass and fruit stains. Write for free samples and terms today. C. H. Stuart & Co., 5068 Spring St., Newark, New York.

**WASH clothes the new way.** Use the Torrent Automatic Washer. You will be delighted. Special offer to one in each locality. Storm Royalty Co., 3614 Enright Ave., St. Louis, Mo.

**SELL union label all-wool made-to-measure suits** direct to wearer for \$24.50. Scott System, Wholesale Tailors, 99C, Bedford Street, Boston, Mass.

**CHEAPEST Self Wringing Mop.** Eastwayco, 405 St. Paul, Baltimore, Maryland.

**AGENTS clear \$50.00 weekly** selling Opaline Portraits. Expense money advanced. Credit given. Big line now ready. Samples and Catalog Free. Consolidated Portrait Co., Desk 5, Chicago.

**AGENTS—Sell men's ready-to-wear suits, topcoats and raincoats** direct to wearer; no investment; big repeat business; commission in advance and big bonus monthly. Send for free selling outfit. The best line in the market, we undersell stores. Henry W. High Co., 306 So. Franklin St., Suite 506, Chicago.

**SELL Men's High Top Boots and High Grade Shoes** Factory-to-Wearer. We are pioneers and leaders in this line. Our men are making \$75 to \$125 weekly everywhere. This proposition is permanent, profitable and worth while. Absolutely the best opportunity in the direct selling field. Carson Shoe Co., Box 123, Essex Station, Boston, Mass.

**MR ADVERTISER: Ask to-day for a copy of the "Quick-Action Advertising Rate Folder."** It contains some really important facts which will prove interesting and valuable to you. It also tells "How You Can Use Popular Science Monthly Profitably." You'd like to know, wouldn't you? Address your inquiry to: Manager, Classified Advertising, Popular Science Monthly, 250 Fourth Avenue, New York.

**More Money Making Opportunities**  
on pages 8 to 21



## What keeps this family so happy?

**WHAT** is play in your family? What good fun do you have that is more than merely fun? Do your good times pay you dividends in more knowledge, more resourcefulness, more fitness for modern life?

Here is one American family that has found the answer.

Look at the boy in this picture. Every healthy boy likes machinery, and wants to know what makes the wheels go round. Isn't this boy's occupation better for him than just casual loafing around the house, or aimless reading of a dime novel.

He thinks his work is fun—and it is. But all the time his home-made radio set is teaching something that is good for his mind, in any event, and that will be of priceless value if he grows up into an engineer, or a manufacturer.

His mother has found something that interests her, too. It is a simple, understandable and authentic book on the great new science of psychology, which all her friends are discussing. And father is smiling over a book on mechanics; it is going to help him in a hundred ways, both in his plant and around the house and garage.

What are these wonderful books that turn play hours into profitable hours? Can you have them, too, in your home?



You certainly can—they are the great new Collier set of books—

### The Popular Science Library

At last—the whole story of modern science and invention in sixteen handy volumes, edited by Garrett P. Serviss

The Popular Science Library brings you the whole march of science up to this very year, this very moment. It is not the work of one man; a single man with the best will in the world could not possibly be an authority on all the branches of scientific thought and progress.

Sixteen great authorities have written it for you. Each one has made a whole book on his own subject, then the library has been edited and put together by one of the most celebrated scientific writers.

It is a constant and complete guide to the questions that arise in the daily life of everyone. It is a stimulating aid to growing child and grown-up person; to the business and professional man alike.

### Do You Know These Facts?

A full grown oyster will produce about nine million eggs.

The deadliest poison of all comes from a plant of the common buttercup family.

In the New York subway 61 per cent of the dust consists of jagged splinters of steel.

Not more than 1 per cent of the available coal in America has been mined.

These are only a handful of the stimulating and useful facts contained in the POPULAR SCIENCE LIBRARY. But we do not ask you to buy it, or any other Collier book, without full information.

Learn all about it before you decide to give your family, and yourself, the happiness and profit that come from owning it. Every reader of this magazine is cordially invited to have this information; the coupon brings it, free of charge, and without obligation.

**P. F. COLLIER & SON COMPANY**  
416 West 13th Street, New York City

Without placing me under any obligation whatever, please send me full particulars of your new Popular Science Library.

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Mrs. \_\_\_\_\_  
Miss \_\_\_\_\_  
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# New Self-Massaging Belt Reduces Waist—Easily!

**Produces same result as an expert masseur, but far quicker, easier and less expensive. Substitutes good, solid, normal tissue for that bulky, useless disfiguring fat, yet does it so gently that you hardly know it is there.**

Science has found a delightfully new way to quickly remove fat and obtain a normal waistline—without straining your heart with violent gymnastics or weakening your system by starving.

Formerly those who wished to reduce without dieting or strenuous exercise had to go to a professional masseur. His method effectively dislodged the fat and brought about the desired reduction. But it was expensive and time-consuming, and so few could take advantage of it.

## Remarkable New Invention

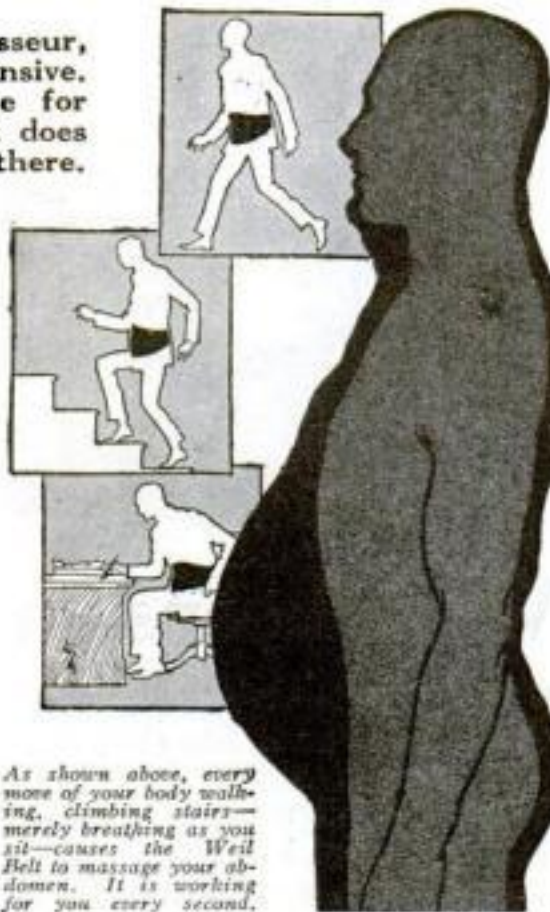
But now a wonderful new invention brings this same effective method within the reach of all. The Weil Scientific Reducing Belt uses this same massage principle, acting by means of its specially prepared and scientifically fitted rubber. It is so constructed that as you wear it every breath you take and every movement you make imparts a constant gentle massage to every inch of the abdomen. Working for you this way every second, day and night, it reduces much more rapidly than ordinary massage, saving both time and money.

## Actually Removes Fat

It does not merely draw in your waist and make you appear thinner. It actually takes off the fat. Within a few weeks you find 4 to 6 inches gone from your waistline. At the same time all your stomach disorders, constipation, backaches and shortness of breath disappear as the sagging internal organs are put back in normal place. Man or woman, you are filled with a wonderful new energy, and both look and feel 10 to 15 years younger.

The Weil Belt is used by hundreds of professional athletes and jockeys because it not only reduces quickly but at the same time preserves their strength. Highly endorsed for its healthful principles by physicians everywhere. Satisfaction guaranteed or your money back without question.

Write today for full description. If you write at once you can also get in on a Special 10-Day offer. Mail coupon today to **THE WEIL COMPANY, 104 Hill Street, New Haven, Conn.**



As shown above, every move of your body walking, climbing stairs—merely breathing as you sit—causes the Weil Belt to massage your abdomen. It is working for you every second.

**The Weil Company,  
104 Hill Street, New Haven, Conn.**

Gentlemen: Please send me, without obligation, complete description of the Weil Scientific Reducing Belt and also your Special 10-day Trial Offer.

Name.....  
Address.....  
City..... State.....

# NERVE STRAIN

The high pressure, mile-a-minute life of today, with its mental strain, worry, anxiety, grief and trouble, not to mention nerve strains resulting from excesses and vices, is **wrecking the nerves** of mankind. This applies especially to the people with highly active brains and sensitive nerves. Have your Nerves stood the strain?

Read "**Nerve Force**" a 64 page book on the care of the nerves. This book is of extreme value to "near-neurasthenics" and people with sensitive and deranged nerves. It has aided many thousands to gain control of their nerves and build up their Nerve Force. Because of the many valuable hints it contains on the control of nerves and mind, "Nerve Force" has been bought by the thousand by large corporations for their employees; it is recommended by physicians to their patients and by ministers to their flocks.

**NERVES OR NO NERVES, YOU SHOULD SEND FOR THIS BOOK TODAY  
PRICE 25c, POSTPAID (COIN OR STAMPS)**

**What Readers of "Nerve Force" Say:**

"I have gained 12 pounds since reading your book, and I feel so energetic. I had about given up hope of ever finding the cause of my low weight."

"I have been treated by a number of nerve specialists, and have traveled from country to country in an endeavor to restore my nerves to normal. Your little book has done more for me than all other methods combined."

"Reading your book has stopped that dreadful feeling of FEAR which paralyzed my stomach and digestion."

"Your book did more for me for indigestion than two courses in dieting."

"My heart is now regular again and my nerves are fine. I thought I had heart trouble, but it was simply a case of abused nerves. I have reread your book at least ten times."

"The advice given in your book on relaxation and calming of nerves has cleared my brain. Before I was half dizzy all the time."

A physician says: "Your book is the most sensible and valuable work I have ever read on the prevention of neurasthenia. I am recommending your book to my patients."

**Write to PAUL von BOECKMANN, Studio 167, 110 West 40th Street, New York City**



**PAUL von BOECKMANN**

Author of "Nerve Force" and various other books on Health, Psychology, Breathing, Hygiene and kindred subjects, many of which have been translated into foreign languages.

## Money Making Opportunities

### AGENTS AND SALESMEN

**THE Clothing Industry** is the second largest business in the country. Men have made fortunes in it. So can you if you go into it right. We'll put you into it right without one penny of expense to you, supply everything you need to go into the business and clear from \$100 to \$200 a week, right from the start. This is a wonderful opportunity for the right man. If you think you are that man, write at once. Address Dept. 632 Goodwear Chicago, Inc., West Adams Street at Peoria, Chicago.

**WONDERFUL** invention eliminates needles for phonographs. Preserves records. Abolishes scratching. Day's supply in pocket. \$20 daily. Sample on approval if requested. Everplay, Desk S-4, McClurg Bldg., Chicago.

**MAKE** money in your spare time. Easy to make \$1 to \$2 an hour by following our instructions. No money or experience necessary. Write today for particulars. Costs nothing to investigate. American Products Co., 2340 American Bldg., Cincinnati, O.

**LIGHTNING** strange battery compound. Charges discharged batteries instantly. Eliminates old method entirely. Gallon free to agents. Lightning Co., St. Paul, Minn.

**DISTRIBUTOR:**—Wonderful Pricing System for all stores. Absolute protection! Immediate repeat sales. Possibilities \$10,000 yearly! Write Manufacturer, Dept. 8, 100 Boylston, Boston, Mass.

**DISTRIBUTORS:**—Screw-holding Screw Driver. Handiest tool ever invented. Unlimited market. Exclusive territories. Big repeat earnings! Write, Coburn Tool 740-U, Boylston, Boston, Mass.

**YOUR** opportunity to connect with a strong old line insurance company selling their new low cost Health and Accident policy which pays \$5,000 death and \$25 weekly benefit. Total cost \$10 yearly. Our Direct-by-Mail plan makes selling easy. Liberal commission paid immediately. Salary in addition. Address, Underwriters 701, Bonnell Building Newark, N. J.

**RADIO:**—Join our sales organization and make big money. We want a man in every county to sell well-advertised sets and parts made by the leading manufacturers. Widener of Kansas City makes \$150.00 weekly. You can do as well or better. Write today for catalogue and discounts. Name your county. Waveland Radio Company, Div 54, 1027 No. State St., Chicago, Ill.

**CLEAN** your car for 5c. Dri-Klean-It removes mud, dirt, dust. No soap or water. Agents wanted. Write American Accessories Co., Dryclean 179, Cincinnati, Ohio.

**MEN'S** Shirts—\$25-\$75 Weekly.—Factory to Wearer. Undersell stores. Free samples. Big Commissions advanced. Illinois Shirt Mfgs., 510 So. Wells, Factory 313, Chicago.

**DISTRIBUTORS:**—Amazing New Invention selling \$2 seals 3500 envelopes hour! Tremendous Demand! Exclusive Territories available! Red E Co., Dept. Q 3, Colonial Bldg., Boston, Mass.

**BIG** money and fast sales, every owner buys gold initials for his auto. You charge \$1.50 make \$1.44 profit. 10 orders daily easy. Samples and information free. World Monogram Co., Dept. 25, Newark, N. J.

**\$100 WEEKLY:**—Pleasant work: Appointing local agents to introduce Mother Hubbard Foods: no canvassing; no delivering; no money invested. Adam Inthout, 550 Congress, Chicago.

**BUILD** splendid business making chipped glass number and name plates. Particulars free. Simplex Co., Dept. 83, 1133 Broadway, New York.

**WE** pay \$48 a week, furnish auto and expenses to introduce our Soap and Washing Powder. Buss-Besch Company, Dept. A 48, Chippewa Falls, Wis.

**\$4 CASH** with every sale of Capt. Burke's Fire-Foe, only pistol-type extinguisher on market; operates with one hand; used on U. S. airplanes; undersells all competition; stops bandits as quick as it puts out fires; factories and institutions buy in quantity; \$20 a day easy; write for sales plans. Burke Fire-Foe Sales Co., Desk B, Cincinnati.

**HAVE** you seen the New Bee Gee Line? Get our 1925 Catalogue and stop worrying about what to sell. You'll be satisfied with what you make. B. & G. Rubber Co., Dept. 755, Pittsburgh, Pa.

**AGENTS:**—\$75 Weekly Selling Nustle guaranteed hosiery. Your pay daily. You write orders, we deliver and collect. Special monthly bonus. Sample outfit furnished. Nustle Hosiery Mills, Dept. 4-4, Philadelphia, Pa.

**AGENTS:**—Signs for stores and offices. Entirely new. \$50 week easily made. World Signs, N. 166 W. Washington, Chicago.

**MARVELOUS** New Invention—400% profit Johnson's Liquid Quick Mend. Tremendous demand. Plan unique. Act quick. Over hundred other fast-selling specialties. J. E. Johnson & Co., Dept. 73, 321 W. Chicago Ave., Chicago Ill.

**MAGIC** Polishing Cloth—great seller—big profit. Try this cloth—it's a money maker. Full size sample free. Get this proposition. Newton Co., 7 Main, Newark, New York.

**CAN** you sell? Tailored-to-measure suits at \$19.75. Universal Tailors, 899 Bedford Street, Boston.

**DUSTLESS** Sponge Cloth, New Invention. (1) Rub—Dusts, Cleans and Polishes Automobiles, Furniture, Planes. Retails 50c.—Costs 16c. Sample Free. NuLife Sponge, Hartford, Conn.

**MR. BRUSH** Salesmen:—Old Established New York Brush Manufacturer requires the services of men in all territories to sell their extensive line of Sanitary Twisted in Wire Brushes. We pay larger commissions than any other Brush House in the country. Write immediately for proposition. Wire Grip Sanitary Brush Corp., 15 Mercer St., New York.

**POLMET** POLISHING CLOTH cleans all metals. Sells fast at 25c. Sample free. F. C. Gale, 15 Edinboro St., Boston.

**ROBT. H. INGERSOLL** of \$1 Watch fame wants good men to sell his Dollar Stropping outfit, an ingenious invention for sharpening all makes of safety razor blades. Great economic value. Meeting with nationwide approval. Easy to sell. Big repeat business. Agents having remarkable success. Full particulars. Robt. H. Ingersoll, 476 E. Broadway, New York City.

**VENDING MACHINE** Salesmen: Sensational plan, sells absolutely new Machines by thousands. Exclusive slug proof device. Established house. Write us quick stating experience. Address Hurd, Wholesale Dept., Ridge Building, Kansas City, Missouri.

**More Money Making Opportunities  
on pages 8 to 21**



## Money Making Opportunities

### AGENTS AND SALESMEN WANTED

**FREE Samples**—"Rain Shield Wiper," retails \$1.00—cost 25c. Just Invented. No Cloth—No Paste—No Attachment. Sold Clear and Rainy Days—(1) Rub keeps Windshield Clear (24) hours. Automobiles buy quickly. Riley made \$198.00 three days. Experience unnecessary. Wonderful Side-line. NuLife Corporation, Hartford, Conn.

**DARN E-Z.** Big Money Selling Twenty Million anxiously waiting to buy. Holes in stockings repaired without Darning. Special selling system furnished agents assures generous income. Large profits, protected territory, sure repeater. Sample 35c. Darn E-Z. Laboratories, Dept. 150, Dayton, Ohio.

**UNIVERSAL Demand**—Large profits in sale of Zev, the Waterless Hand Soap. Every auto and truck driver will want one or more cans this year. Can be used without water for a quick clean-up after changing tires, etc., when water is not available. Leaves the hands clean, soft and dry. This is your Big Opportunity of the year, if you are looking for a quick seller with big profits. Send postcard to Parke Corporation, Dept. P, Kalamazoo, Mich., for particulars.

**BIG Money in Formulas.** 10,000 selected manufacturing formulas and trade secrets. One great book. Highly recommended. Write for astonishing offer. Southern Trading Co., Dept. 26, Flushing, N. Y.

**RADIO Salesmen and Set Builders**—We need you and you need us. If you are reliable and well known in your community, we will appoint you our representative and furnish you with standard well advertised sets and parts at prices that will enable you to sell at a handsome profit. Write at once for catalogue and sales plan. Waveland Radio Co., Div. 55, 1027 N. State St., Chicago Ill.

**SALESMEN** to sell suits and overcoats tailored by us and direct to wearer at \$23.50; none higher. Sold under positive guarantee of satisfaction or money returned and with privilege of wearing one week and then returning if unsatisfactory. Easy to sell. Commissions daily. Write for plan. Chain Clothing Stores, 500 Fifth Avenue, New York City.

**AGENTS:** Make \$1 to \$5 hour selling Bamboo Self-Filling Fountain Pens, and Novelties, "Special" Sample 55c. Write for particulars. Cordell McDaniel Company, Salisbury, N. C.

**35c PROFIT** 50c sale. Repeats. Kingsbury Company, Dept. PSM, Fort Wayne, Indiana.

**AGENTS:** \$11.80 daily in advance (send for sworn proof) Introducing New Insured Hosiery. 47 styles, 35 colors, guaranteed seven months. No capital or experience required. You simply take orders. We deliver and collect (or you can deliver, suit yourself). Credit given. Pay You Daily, monthly bonus besides. We furnish samples. Spare time will do. Macochee Textile Company, Station 1524, Cincinnati, Ohio.

**ARE you old at forty?** See our advertisement on page 141 of this issue. The Electro Thermal Company, 4044 Main St., Steubenville, Ohio.

**ONLY one sale a day means \$200 per month!** Five sales \$1,000 per month. Marvelous new adding machine. Retails \$15.00. Work equals \$350 machine. Adds, subtracts, multiplies, divides automatically. Speedy, accurate, durable, handsome. Five year guarantee. Offices, stores, factories, garages buy one to dozen. A fortune for live agents. Write quick for protected territory and free trial offer. Lightning Calculator Co., Dept. P, Grand Rapids, Michigan.

**NEW Discovery.** Starting, sensational products. Proven success. 500% profit. Particulars Free. N. Roth, 3949 Metropolitan, Chicago.

**SUCCEED With Your Own Products**—Formulas by experts. Manufacturing processes. Trade secrets. Modern master methods. Catalog free. C. Thaxly Co., Washington, D. C.

**SELLS at sight.** Our new improved machine prints merchant's ad on wrapping paper, bags, boxes, etc. Good commission plus bonus. Automatic Ad-Stamp, Joplin, Mo.

**BIG money selling gold initials.** Quick sales. Every car owner buys. You charge \$1.50—make \$1.44 every sale. Your profit \$20 daily. No license. No experience. "Samples free." NuLife (P) Monogram Company, Hartford, Conn.

### HELP WANTED—INSTRUCTION

**\$133-\$192 MONTH.** Traveling. Railway Postal Clerks. Steady. 25 trained free. Write immediately. Franklin Institute, Dept. B-39, Rochester, N. Y.

**RAILWAY** mail clerks, \$133-\$192 monthly. Many other openings, \$117-\$250 per month. Information free. Write immediately. Chicago Civil Service College, T-70, Kesner Building, Chicago.

**ALL men, women, boys, girls, 17 to 65,** willing to accept Government Positions, \$117-\$250, traveling or stationary, write Mr. Ozment, 295, St. Louis, Mo., immediately.

**DETECTIVES Earn Big Money.** Excellent opportunity. Travel. Fascinating work. Experience unnecessary. Write, George Wagner, former Government Detective, 1968P Broadway, N. Y.

**MEN Wanted for Detective work.** Experience unnecessary. Write J. Gabor, former Govt. Detective, 106, St. Louis, Mo.

**BE a detective.** Excellent opportunity to earn big money, travel, thousands of dollars offered in rewards. Established 1909. Particulars free. Write to C. T. Ludwig, 424-D Westover Bldg., Kansas City, Mo.

**FIREMEN, Brakemen, Baggage-men, Sleeping car, train porters (colored)** \$140—\$200. Experience unnecessary. 838 Railway Bureau, East St. Louis, Ill.

**MR. ADVERTISER:** Ask to-day for a copy of the "Quick-Action Advertising Rate Folder." It contains some really important facts which will prove interesting and valuable to you. It also tells "How You Can Use Popular Science Monthly Profitably." You'd like to know, wouldn't you? Address your inquiry to: Manager, Classified Advertising, Popular Science Monthly, 250 Fourth Avenue, New York.

### DISTRICT MANAGERS AND REPRESENTATIVES WANTED

**WORLD'S fastest selling auto accessory!** County distributors wanted; write to-day. G. L. W., Spring Oiler Co., San Diego, California.

**WANTED**—District Purchasing Agents, no experience or money required. Write: Purchasing Manager, Dept. 11K, 5336 Berenice, Chicago.

**WRITE for a copy of our "Quick-Action Advertising Rate Folder"**—It contains information of real value to you. Popular Science Monthly, 250 Fourth Avenue, N. Y.

**More Money Making Opportunities**  
on pages 8 to 21



## Daring Young Men Needed in Aviation

**T**HERE is no field of work in the world today which offers such amazing opportunities to young men of daring and who love adventure, as does Aviation. Although still in its infancy, there is a crying demand in Aviation for young men with courage, nerve and self-reliance. For those who can qualify there will be thousands of highly paid jobs which will lead quickly and surely to advancement and success.

### Big Opportunities Await the Trained Man

Look over the fields of work which are open to the young man today. You will find that Aviation is the ONE FIELD that is not overcrowded—the ONE FIELD in which there is plenty of room at the top. Think of it! Only 21 years ago Orville and Wilbur Wright made the world's first airplane flight. Now airplanes fly around the world. Yes, Aviation offers the same wonderful opportunities today that the automobile and motion picture industries did 15 and 20 years ago. Men who got in on the ground floor of those industries made fortunes before others woke up. AVIATION IS NEW! It clamors for nifty young men—and the trained man has the world before him in Aviation.

### Easy to Become an Aviation Expert—\$50 to \$100 a Week

You can qualify now quickly for one of these exciting, highly paid jobs through a new, sure, easy method of training. The study of Aviation is almost as interesting as the work itself. Every lesson is fascinating and packed full of interest. That's why Aviation is so easy to learn—you don't have to force yourself to study—once you start, you can't get enough of it. Only one hour of spare time a day will give you the basic training in an amazingly short time.

One student, S. F. McNaughton, Chicago, says:

"Your lessons are like a romance, and what is more, after one reading, the student gets a thorough understanding. One never tires of reading them." James Powers, Pa., another student, says: "I am indeed surprised that such a valuable course can be had from such practical men for so little cost."

### Personal Instruction by Experienced Men

Men who have had actual experience in Aviation give you personal attention and guide you carefully through your training. They select the lessons, lectures, blueprints and bulletins. They tell you the things that are essential to your success. Every lesson is easy to read and quickly understood.

## Big Book on Aviation FREE

Send coupon below for New Free Book, just out, "Opportunities in the Airplane Industry." It is interesting and instructive and will show you many things about Aviation which you never knew before. Only a limited number offered—get yours before the edition is exhausted.



**AMERICAN SCHOOL OF AVIATION**  
Dept. 1364, 3601 Michigan Ave., Chicago, Ill.

**AMERICAN SCHOOL OF AVIATION,**  
3601 Michigan Ave., Dept. 1364,  
Chicago, Ill.

Without any obligation, send me your Free Book, "Opportunities in the Airplane Industry," also information about your Course in Practical Aeronautics.

Name.....  
Street.....  
City..... State.....





## You are Wanted for a Better Job

and you can get it with our help, because we've already helped thousands of men to bigger pay and better positions. Mail the coupon and get the Proof that we can Raise Your Pay. Now read these pay-raising facts.

### From \$2 a Day to \$200 a Month

We helped John Braund from a Laborer at \$2 a day to an expert Draftsman at over \$200 a month. Thomas English jumped from machinist's helper to expert Draftsman immediately upon securing our training. Joseph Ohaus was advanced from mill hand to expert Draftsman with Public Service Gas Co. P. A. Foor jumped from \$65 a month to successful drafting business of his own. From low paid vulcanizer to expert Draftsman, in eight short months, tells the story of L. R. McGlashan. M. B. Uley received a \$15 raise after six months of our help.

### \$275 Extra in 3 Days

One man received \$275 for a drawing he made in 3 days' spare time after taking our training. But these are just a few—clip the coupon and get all the startling proof that we can do the same for you.

"Columbia" will train you, in your spare time, at home to be an expert Mechanical Draftsman in a field where men are always wanted by big concerns, at big pay.

### Promotion Is Quick

We'll qualify you for a high salaried position in the Drafting field and keep you in touch with openings for Draftsmen in the big machine shops, industrial plants and United States Government departments.

Men who start as Draftsmen are often advanced to Chief Draftsmen, Chief Engineers, Production Managers and so on.

### Get the Right Training

Mr. Roy C. Claflin, the founder and director, stands personally in back of the Columbia School of Drafting. You spend no time in long winded theories—useless and expensive to you. You start on actual drawing work the day you receive your first lesson.

### You Need No Previous Training

The course is easy to understand and easy to follow. Many students are qualified even before they complete the course.

### Success Calls Men of Action Only

If you are a man of action—clip the coupon now and show that you are a man of action. Keep right on top of this opportunity to make real money. Don't go looking for a pair of scissors. Tear the coupon off and mail it right now. Get started now.

## Columbia School of Drafting

ROY C. CLAFLIN, President  
DEPT. G-130 WASHINGTON, D. C.



### FREE DRAFTING OUTFIT

We give you FREE with our course this high-grade Professional Drafting Outfit. It is yours to keep when you complete the course.

### FREE BOOK COUPON

COLUMBIA SCHOOL OF DRAFTING  
Dept. G-130  
14th and T Sts., N. W., Washington, D. C.

Please send me without charge your free illustrated book on Drafting, telling me how I can secure your complete home study course and your help in securing a position as Draftsman.

Name.....  
Address.....  
City..... State.....

## Money Making Opportunities

### BUSINESS OPPORTUNITIES

LEARN the collection business. Good income; quick results. Interesting booklet, "Skillful Collecting," free. National Collector's Association, Science Building, Newark, Ohio.

MEN, to sell regular \$1.00 and \$1.50 silk and knitted ties for 35c and 50c. Make \$15.00 daily. Write for particulars. American Cravat Exchange, 621 Broadway, New York.

BECOME a Foot Correctionist. A New Profession not medical nor chiropody. All the trade you can attend to; many are making \$3000 to \$10,000 yearly, easy terms for training by mail, no further capital needed or goods to buy, no agency or soliciting. Address Stephenson Laboratory, 10 Back Bay, Boston, Mass.

GOLD, Silver, and colored Sign Letters for windows, automobiles, trucks. Make them yourself with our Process and Letter Patterns. Fast sellers. Big profits. No experience. Stamp brings actual sample. Witterding, 1144 Pleasant Street, Oak Park, Illinois.

GET money in your mail. "Lambert's Mail Order Secrets" contains successful methods never before published. Particulars free. Leon Lambert, 555-D Kaufman Bldg., Wichita, Kansas.

INCH Display Advertisement, 166 Magazines, Year, \$50. Wood's Popular Services, Atlantic City.

PATENTS procured; Trade Marks Registered—A comprehensive, experienced, prompt service for the protection and development of your ideas. Preliminary advice gladly furnished without charge. Booklet of information and form for disclosing idea free on request. Richard B. Owen, 44 Owen Bldg., Washington D. C., or 41-Z Park Row, New York.

SIGNS and Showcards easily painted with Letter Patterns. Large variety of styles and sizes. Sample for stamp. John Rahn, G2433 Greenview Ave., Chicago.

MEN, women, make the Artcov, and money. Information free. Artcov Mfg. Co., Stop 50, Condado, P. R.

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RECEIVE money in your mail. "Mongers Mail Order Secrets." Successful methods yet unpublished. Particulars Free. O. L. Monger, 138½ N. Main St., Dayton, Ohio.

USED Correspondence courses of all schools sold, rented and exchanged. List free. (Courses bought.) Lee, Mountain, East Chattanooga, Tenn.

FREE Booklet. How to Become Successful in Real Estate. Macdonalds Cooperative Realty, San Diego, California.

STOP plodding! Be successful. Operate a tire repair shop. Make big profits in any locality. We teach you and furnish complete equipments, \$100 up. Book of Opportunity free. Haywood's, 1306 South Oakley Avenue, Chicago.

A BUSINESS of Your Own—Make and Sell Chipped Glass Name and Number Plates, Checkersboards, Signs. Large Booklet Free. E. Palmer, 513, Wooster, Ohio.

\$10,000 YEARLY Guaranteed, doing professional work you'll like. Leaders, 159 N. State, Suite 1106, Chicago.

I MADE \$30 a week home. French bread-making. 15 years' experience. Free booklet tells. Ashbrook, E. 67, Marengo, Ohio.

MR. ADVERTISER: Ask to-day for a copy of the "Quick-Action Advertising Rate Folder." It contains some really important facts which will prove interesting and valuable to you. It also tells "How You Can Use Popular Science Monthly Profitably." You'd like to know, wouldn't you? Address your inquiry to: Manager, Classified Advertising, Popular Science Monthly, 250 Fourth Ave., New York.

BIG profits in your spare or full time. Establish your own permanent business without capital. No peddling nor soliciting. No outfit to buy. We teach you how to get the business that is all around you. Write today for free book—no obligation. Carpenter Company, Sunderland Building, Omaha, Neb.

A NEW Mail Order Book tells exactly how to start, grow and win. Latest methods explained, new ideas, up-to-date pointers. Free circular tells all about it. Be first! Marion MacRae, Publisher, 805-S Oregonian Bldg., Portland, Oregon.

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FREE folder describes 27 plans for making \$20.00 to \$100.00 weekly in home or office business of your own. Downs Co., 2326 Myrtle, St. Paul, Minn.

SUCCEED With Your Own Products—Formulas by experts. Manufacturing processes. Trade-secrets. Modern master methods. Catalog free. C. Thaxly Co., Washington, D. C.

THE Venture of a Century. \$2.50 buys 1,000,000 mark German Government 1923 Bond. Wanted German bonds dated prior to 1920. All foreign bonds and currency dealt in. Frank B. Everett & Co., 35 Wall St., New York.

BOYS Earn Big Money. Our free new plan makes it easy. Write today. Dept. C-2, Arab Products, Niagara Falls, N. Y.

FREE instruction book. Start Mail Order Business home evenings. Pier, 715 Cortlandt St., N. Y.

150 MONEY Making Plans Free! Wolverine Bureau, PS-4, Muskegon, Michigan.

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More Money Making Opportunities  
on pages 8 to 21

## Most Wonderful Musical Instrument Ever Invented



Play  
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Minute!

No Lessons—  
No Practice

Greatest musical sensation of the age! Never before anything like it. Everybody simply wild about this

20th Century  
Wonder

No more high cost, hard lessons and long practice. At last a Musical Genius has invented a marvelous instrument that anyone can play who can hum a tune.

This instrument is

The Marvelous

## Mussehl's Slide- Trumpet-Sax

TRADE MARK.

A big, full-sized musical instrument made of solid brass, polished and finished like the very finest Saxophone. You don't need to know the first thing about music. You don't have to practice, not a minute.

### You Can Play It

Just HUM a tune in it, that's all. And, oh how the music rolls out—sweet and mellow like the dreamy Saxophone or loud and clear like trombone or trumpet. This seems too good to be true. But it is true—any man, woman, boy, girl, can play immediately. No lessons, no practice—just hum your favorite tune.

## FREE

We will send you a phonograph record of a beautiful solo played on Mussehl's Slide-Trumpet-Sax. You will simply be amazed at the sweet, mellow music produced by this wonderful instrument that sounds like a saxophone.

With the free record we will send you our amazing LOW Price Introductory Offer, a price so low that anyone can easily afford it. Remember—you can play immediately with marvelous sweetness—any tune you can hum.

### Send for FREE Phonograph Record Today—SURE

MUSSEHL & WESTPHAL  
520 Water St., Ft. Atkinson, Wis.

MUSSEHL & WESTPHAL,  
520 Water St., Ft. Atkinson, Wis.

Gentlemen—Send me the Phonograph Record of Solo played on Mussehl's Slide-Trumpet-Sax and your Low Price Introductory Offer. It is understood that this request places me under no obligation of any kind. Please print or write very plainly.

Name.....  
Address.....



## Money Making Opportunities

### HELP WANTED

EARN \$1.20 an hour cutting blanks at home; spare time. Men only. Send addressed reply envelope. Goodyear Sm., 147 W. 23rd St., New York.

WANTED—Representatives in every factory in the United States. Popular Science Monthly, 250 Fourth Ave., New York.

MEN to build radio sets in spare time. Leon Lambert, 555-D Kaufman Bldg., Wichita, Kansas.

SILVERING Mirrors, French plate. Easily learned; immense profits. Plans free. Wear Mirror Works, Excelsior Springs, Mo.

OUR genuine gold window sign letters are an excellent money-making proposition for handy men. Slans Sign System, East Bethune Avenue, Detroit, Michigan.

MEN wanting forest ranger, postal clerk and other government positions; particulars free. Write Mokane, Dept. A-30, Denver, Colo.

EARN \$5.00 to \$35.00 weekly mailing circulars at home. Outfit and instruction 25c. Jamorris, 2305 Gratz, Phila., Pa.

\$100-\$200 WEEKLY. Men with slight knowledge of motors who can reach car owners can earn \$200 weekly without making a single sale. If they can also make sales, profits may reach \$15,000 yearly. W. Y. Phillips, 235 West 27th St., New York.

ARE you old at forty? See our advertisement on page 141 of this issue. The Electro Thermal Company, 4044 Main, Steubenville, Ohio.

GOOD Money easily earned at home spare time Silvering Mirrors. Glass Embossing, Chipping, Frosting, Gold Leafing, etc. Patterson & Co., Brooksville, Ky.

IF you want to distribute free samples, circulars, etc., in own locality, write quick. Absolutely no selling. Excellent pay. Moore Advertising Co., Drawer 488, Zanesville, Ohio.

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1000 DIFFERENT Stamps, wonderful quality, \$1.00. C. E. Nickles, 3002 Rodman St., Washington, D. C.

YOU'LL get profit and pleasure collecting old coins. Send 10c for genuine old coin and large coin catalog. This is just a get-acquainted offer. Send today. You'll be delighted with it. B. Max Mehl, Numismatist, Dept. 8, Mehl Building, Fort Worth, Texas. Largest Coin Firm in U. S.

OLD Coins. Large Spring Selling catalogue of coins for sale free. Catalogue quoting prices paid for coins, ten cents. William Hesslein, 101B Tremont Street, Boston, Mass.

500 MIXED Stamps from 40 different Countries, Australia, North, Central, and South America, Russia, Africa, China, Japan, British, French, Colonies, War issues, etc., also 500 stamp hinges, pocket approval book, perforation gauge, and 3 United States stamps issued before 1870, all for 25c. Biggest bargain ever offered. Satisfaction guaranteed or money back. Hussman Stamp Co., Dept. F. S., St. Louis, Mo.

FREE 25 different U. S. stamps with 60% approvals. 45 different U. S. 10c. Seidenberg, Baroda, Mich.

JAPAN—40 different 15c. Browne, 90 Kemper St., Wollaston, Mass.

STAMPS, 100. All different, 3 cents. Lists free. P. S. Quaker Stamp Co., Toledo, Ohio.

100 RARE stamps, all different, bargain lists, Stamp Magazine, everything 7c. Stanton, Niantic, Conn.

1,000 DIFFERENT stamps \$1.00. Fred Onken, 630 79th Street, Brooklyn, N. Y.

COLLECT Precancels—50 different, 12c. Approvals—Reference. "Badger" Brooksville, Florida.

100 DIFFERENT stamps free to popular approval applicants; postage 2c. Christensen, 124 Second Street, Milwaukee, Wisconsin.

RARE Coins, Medals, Paper Money. United States, Foreign and Ancient. Old Coin and New Catalogue, 10c. Alexis Mengelle, Box 387, Colorado Springs, Colo.

STAMPS—50 varieties, Africa, Brazil, Peru, Cuba-Mexico, etc., 10c. 50 different U. S. 25c. 1,000 hinges—10c. 1,000 mixed, 40c. List free. C. Stegman, 5049 Cote Brillante, St. Louis, Missouri.

17 VARIETIES Bulgaria stamps, 20 cents. List of 7,000 low-priced stamps free. Chambers Stamp Company, 111 C. Nassau Street, New York City.

CALIFORNIA gold \$1/4 size, 27c.; \$1/2 size, 53c. White cent and catalogue, 10c. Norman Schultz, Colorado Springs, Colorado.

\$5.00 FOR 10c.—200 all different (mostly unused) from Ireland, Newfoundland, Jamaica pictorial, etc., triangle set, airplane set, small album and bargain lists—all for 10c to new approval applicants. Victoria Stamp Co., London, Canada.

100 Different foreign 3c. Theodore Oliver, 813 Richmond Ave., Buffalo, N. Y.

100 DIFFERENT New Europe Free to Applicants for our Net Approvals, Postage 2c. Badger Stamp Co., Milwaukee, Wis.

OLD Foreign Coin sent Free. Cornish Company Schenectady, N. Y.

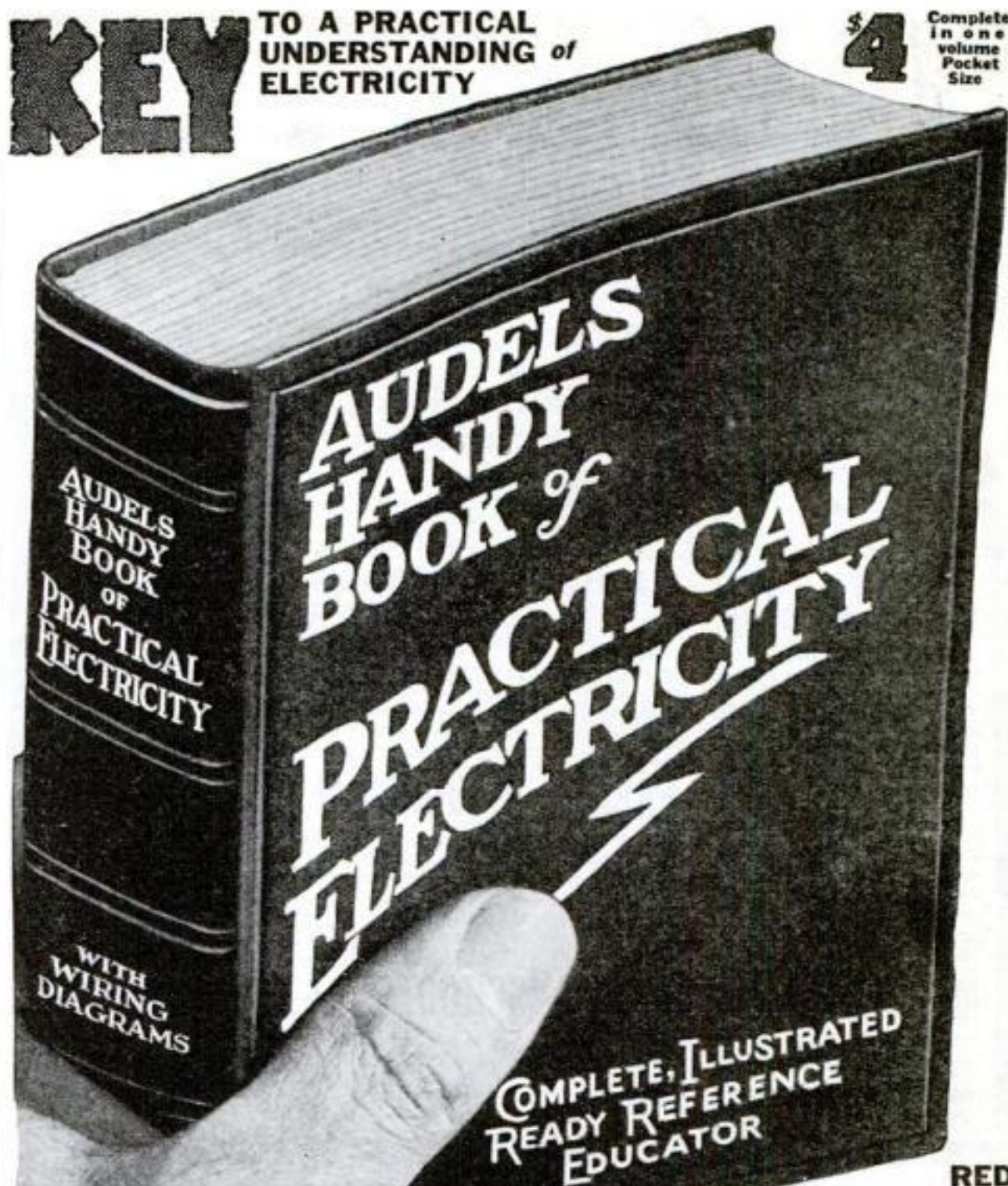
NEWFOUNDLAND Postage Stamps "given away" 1 Thirty variety packet 30c. Rev. Butler, St. Georges, Newfoundland.

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**More Money Making Opportunities**  
on pages 8 to 20

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Dynamoes  
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Think of it—eight short weeks in any of my schools—Then a big pay job—success! You don't have to know a thing about cars—you don't have to have any education—all you need is the determination to get ahead. In eight weeks you'll be, not merely a Garage Mechanic, but an Auto, Tractor and Electrical Expert—a big-pay man.

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For a very limited time, I am going to pay your Railroad Fare to my nearest school—and board you absolutely free while you are there—And in addition, I am going to make you a very special tuition offer. Send today for my free catalog. You'll have to hurry, though.



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J. H. McSweeney, Pres., Dept. 260  
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Send this coupon to the School nearest you  
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Let me have the full details of your special offer.  
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Address.....

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Send me, entirely free, Booklet No. D-117 giving full particulars about course in Railway Traffic Inspection.

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Write at once for package Premiere Finger Print Powder (officially endorsed by police and detective departments—something new and superior). Complete instructions in scientific, mechanical, and chemical detection of finger prints sent free with each package. Can be learned in one evening.

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Our students are making \$50 to \$150 a week originating lettering for Magazine and Newspaper advertisements, Booklets, Posters, Trade Cards. Easily quickly learned by one home study method. **Rig Demand** for work of our graduates. Write for FREE BOOK today. **UNITED SCHOOLS** 3108 KEITH BLDG - CLEVELAND, O.

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SCHOOL OF ENGINEERING OF MILWAUKEE  
PSM-425 415 Marshall Street Milwaukee, Wis.



# Could She Love Him Were He Bald?

ON what a slender thread hangs interest—Affection—Love!

She notices, for the first time, some tell-tale specks of dandruff on his coat, and that his hair is getting thin on top. What if he should lose it! Could she love him then—if he were bald—bald as Uncle Charley?

The very thought is a severe shock to her, for she has always been so proud of his personal appearance—and her own. Wherever they have gone together, the verdict of their friends has been, "What a good-looking couple."

But if he should lose his hair—if he had a shiny, bald head—she just couldn't stand it. Anything but that. She wouldn't mind a sweetheart or a husband whose hair was gray, or even one with a red head—but a bald head . . .

Could any girl's romance survive *that* blow?

## New Hair for You In 30 Days —Or No Cost!

Don't let thin, scanty hair ruin *your* personal appearance. It isn't necessary.

If you are worried over the condition of your hair

—if it is falling out

—if it is getting thin on top

—if your bald spot is growing larger every day

send at once for our free booklet, which gives you full particulars of an easy, simple home treatment that has grown new hair in one month's time for hundreds of people.

Don't say "It's too good to be true." Don't be skeptical. Don't doubt. Investigate. That's the only wise thing to do. It costs you nothing to find out what this treatment has done for others—what it can do for *you*.

So, mail the coupon now. Learn all about this marvelous, new treatment that produces such amazing results.

### Proof of Success

You are not asked to take our word in this important matter. We can refer you to hundreds of delighted people for whom we have grown new hair, after all other remedies failed. Read these brief extracts from a few of the hundreds of grateful letters, which are on file in our offices, open to your personal inspection:

"The top of my head is almost covered with new hair. I have been trying for last five years, but never could find anything that could make hair grow until I used your treatment, and now my hair is coming back."—Tom Carson, Ohio.

"Hair stopped falling out and quite a lot of fine new hair is coming in where my head was bald. Can highly recommend it."—F. L. W., San Francisco, Cal.

"Lots of hair is growing where I was bald. It was just as bare as the palm of my hands. New hair is coming again."—C. Fitzgerald, New York.

"I have gained remarkable results. My scalp now is all full of fine new hair. I am well pleased with results."—A. W. B., Maywood, Ill.

"A new growth of hair has shown on each side of temple where I have been bald for years."—Chas. Barr, New York.

If you want just such results as these people are getting—if you want to stop your falling hair—cover up your bald spots—improve your personal appearance—let us hear from you at once.



### Free Booklet Tells All

All you need do to obtain full details of this easy, pleasant, home treatment, that grows new hair in thirty days or costs you nothing, is to sign and mail the coupon at the bottom of this page.

This interesting, 32-page booklet, not only fully explains our simple, scientific system of growing new hair, but it gives you positive proof of what we have done for others, together with photographs showing what can be accomplished.

Act promptly. The sooner you get this informative little book, the sooner you can stop your hair from falling out—start to cover up the bald spots—begin to improve your personal appearance.

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512 Fifth Avenue New York

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Dept. 174, 512 Fifth Avenue, New York

You may send me, in plain wrapper, **without cost or obligation**, a copy of your new booklet telling all about the Merke Institute Home Treatment for stopping hair from falling out, growing new hair and improving one's personal appearance.

Name.....  
(State whether Mr., Mrs. or Miss)

Address.....

City..... State.....



# Jorgensen

## STEEL SPINDLE ADJUSTABLE HAND SCREW



## "The Handiest Tool in my Workshop"

### A Few Uses

- Holding radio panels while drilling.
- Clamping wood pieces while gluing them.
- Holding metal parts while soldering.
- Using hand screws as a vise when sawing, etc.
- Holding templates while marking work.

"YOU ought to get one of these handy Jorgensen Hand Screws for your tinkering, Bill. It saves a lot of time and trouble mending furniture, drilling radio panels, and dozens of other things I do around the house. But listen, Bill, don't get one of those old-fashioned hand screws with wood spindles. Be sure to get one of these Jorgensen 'steel spindle' Hand Screws. They don't break or warp, and you can hold things at an angle, too!

"If the hardware dealer hasn't any of these Jorgensen Hand Screws, send for one or two by mail. I know all the big mechanics' supply houses sell them. It's easy to get them, either way. You better get busy, today, Bill, and write to the

### Adjustable Clamp Co.

Manufacturers of the  
"JORGENSEN"  
STEEL SPINDLE HAND SCREWS  
212 N. Jefferson Street, CHICAGO

### A Word to Manufacturers

Jorgensen Steel Spindle Hand Screws are made in sizes from 4" to 24" for all factory uses. Send for literature and prices.



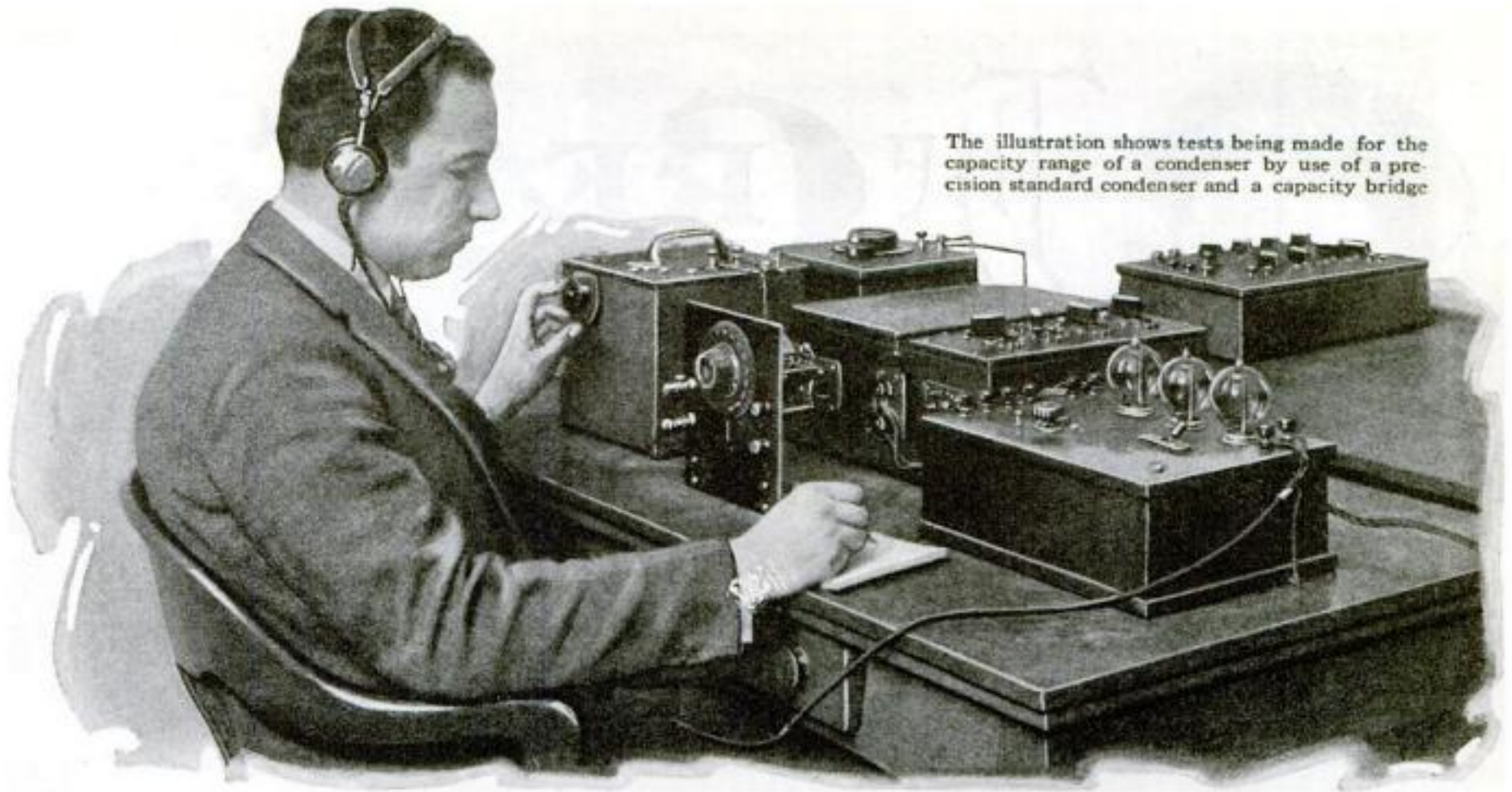
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Please send items checked below:  
☐ Latest descriptive circular.  
☐ Ship by mail, postage prepaid, ONE No. 5/0 JORGENSEN Hand Screw (jaws 4" long, opening 2"), for which I enclose \$1.00.  
☐ Ship by mail, postage prepaid, ONE No. 0 JORGENSEN Hand Screw, (jaws 8" long, opening 4 1/4"), for which I enclose \$1.50.  
 Money will be refunded if tools are not satisfactory and are returned in good condition in 30 days.

Name .....

Address .....





The illustration shows tests being made for the capacity range of a condenser by use of a precision standard condenser and a capacity bridge

## The Institute Tests Variable Condensers

By Thomas Vanacore, B.S.

Assistant Radio Engineer

Popular Science Institute of Standards

**P**URCHASERS of condensers almost invariably specify that a "low-loss" condenser is desired. And they usually get a low-loss type of condenser—but it is not low loss in the commonly understood sense of the word.

This is a point that is stressed particularly by the Popular Science Institute of Standards. No condenser can be advertised in POPULAR SCIENCE MONTHLY as a "low-loss condenser" unless the tests made by the Institute have proved conclusively that the condenser actually is a low-loss condenser. Nor can any condenser, or other radio and tool product, be advertised in the columns of POPULAR SCIENCE MONTHLY unless they come up to the standards of the Popular Science Institute of Standards.

In the radio industry the term "low loss" has come to signify a certain type of condenser. If the construction of a particular condenser of this type follows along correct electrical design, the losses will be low. However, there are many condensers of this low-loss type whose losses are actually greater than is the case with the older type of condensers.

In our laboratory we determine the losses both at 1000 cycles and also at the usual radio frequencies. We measure these losses in terms of an equivalent series resistance and express the efficiency of the condenser on this basis in terms of its phase angle difference.

Therefore, a condenser that is sub-

mitted to the Popular Science Institute of Standards as a low-loss condenser must have a particularly low phase angle difference, in addition to the other Institute requirements.

In general, approval of condensers is based on the following points:

- 1—Quality of workmanship
- 2—Mechanical construction
- 3—Electrical efficiency

It is essential in a condenser that the insulating material be of good quality and properly placed if it is to give maximum efficiency. The contacts in a condenser must be positive, the bearings smooth

running, and the plates must be spaced accurately and clamped strongly. We also determine whether the dial be calibrated well, the rotary plates locked together and secured firmly to the shaft, and whether a counterweight is provided for the panel mounting types.

All variable condensers on the approved list of the Popular Science Institute of Standards have been proved by test to be of trouble-proof mechanical construction, high ratio of maximum to minimum capacity, low phase angle difference and high insulation resistance.

A precision standard condenser and a capacity bridge form the essential part of the equipment for making such tests. These are illustrated above.

Since the condenser plays such an important part in a radio receiving set, great care should be taken in its selection. In selecting a condenser from the approved list of the Institute, one may be certain that he is adding to the efficiency of his set.

It is obviously impractical for even as completely organized a bureau as the Institute of Standards to test all products listed in tool or radio catalogues advertised in our columns. Only tool and radio products specifically advertised in POPULAR SCIENCE MONTHLY are tested and approved by the Institute.

### Send for List of Approved Products

POPULAR SCIENCE MONTHLY will be glad to furnish a list of Radio and Tool Manufacturers whose products have been approved by THE INSTITUTE.

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Popular Science Monthly guarantees every article of merchandise advertised in its columns. Readers who buy products advertised in Popular Science Monthly may expect that these products will give absolute satisfaction under normal and proper use. Our readers in buying these products are guaranteed this satisfaction by Popular Science Monthly.

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# THE GREBE

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of what use are they?"

It is easy to prove the claims  
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If you have once operated a Synchrophase you will not be satisfied with any other type of receiver, because Grebe exclusive and fundamental features provide reception that is unsurpassed.

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This perfection extends also to the Synchrophase cabinet. It is beautifully designed and built of solid mahogany, highly polished and with delicately embossed gold escutcheons.

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*This company owns and operates station WAHG*



Synchrophase with  
battery base





## The Magic Stuff that Saved Nome

*How, in the Blood of Horses, Are Produced Invisible Conquerors of Human Disease*

By Edward Mott Woolley

**A** NEW Epic of the North, greater by far than any from the master pens that have celebrated the Arctic, was written recently when seven relays of intrepid mushers, lashing their dog teams to unprecedented efforts, sped over the trackless Alaskan trails to carry life-saving antitoxin to the city of Nome, stricken by an epidemic of diphtheria, the famous "black death" of the North.

Fighting withering cold, fierce gales, and roaring blizzards, these Spartans of the snows urged on their fleet huskies to accomplish the 660-mile journey from Nenana to Nome in the record-breaking time of 127½ hours—approximately 5½ days—faster by far than dog sled ever had traveled before, even in the "derbies"—races for generous prizes—in which the best Alaskan dog teams contest each year. Never did the purses and honors of those derbies prove such reason for pressing on to the very limits of human endurance as did the call of suffering humanity that seemed to ring in the ears of the drivers as they struggled over the snows.

Twenty-seven persons lay sick of the dread disease when Gunnar Kasson and his 13 dogs pushed wearily into the settlement with the precious 20-pound package containing 300,000 units of the life-saving serum. Twenty-eight others had developed what appeared to be symptoms of the scourge while Kasson, and Leonard Seppala, most famous of all Alaskan sled drivers, and Tom Green, and Shannon, and Nicolai

and the others were carrying the needed serum over the snowswept trails. A frightful list of patients, this, in a community with a population of between only 600 and 800 souls. Compute the same proportion of disease cases in a city of a million, and you will appreciate how critical the situation was.

The eyes of the whole world have been turned toward the little settlement on the fringe of the Arctic Circle ever since the telegraph first told of the grim drama that was being played near the top of the world. All honor has been paid to the courageous drivers, who, with striking modesty, said that their feat was "all in the day's work" and insisted upon passing credit along to their dogs; also to Dr. Curtis Welch,



**Heroes in the Race with Death**

Leonard Seppala, champion musher of Alaska, with two of his famous lead dogs. In the face of a raging blizzard they sped over 245 miles of trackless snow in the longest of seven dog-sled relays that carried 300,000 precious units of diphtheria antitoxin to plague-stricken Nome. All Alaska speed records were broken



**Germes to Fight Germs**

Inspecting the growth of bacteria in laboratory cultures. The killed bacteria, injected into the blood of animals, arouse the life cells to produce the disease-resisting antibodies that are contained in the antitoxin serums

of the U. S. Public Health Association, who, with the assistance of a single nurse, battled ceaselessly with the hosts of death before the antitoxin arrived.

But there are other men—other animals, too—deserving of credit for the parts they played in that thrilling episode. They did not face the rigors of the Alaskan winter, nor dare death under circumstances so dramatic that the attention of the world was focused on them. Yet in their own way they served, and served well, for it was they who produced the magical stuff—the antitoxin—without which the heroic efforts of the Alaskan sled drivers would have been in vain.

**I**T IS a fascinating story, this tale of the efforts of science to end the ravages of diphtheria, pneumonia, typhoid fever, spinal meningitis, erysipelas, lockjaw and the other deadly maladies of humankind through the production of what scientists call "bacteria antibodies," or "immune serums," which are Nature's weapons against the germs of disease.

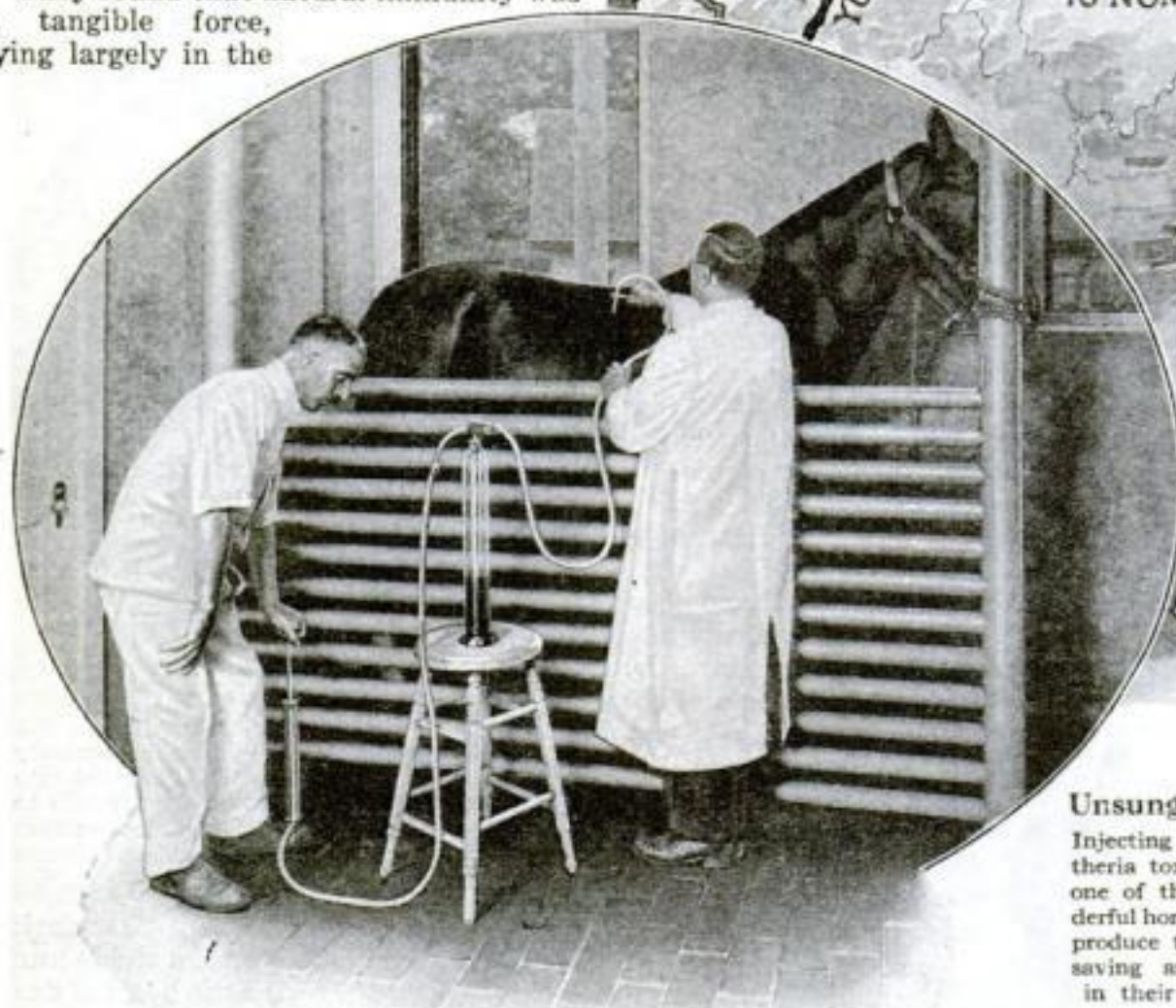
All around us continually lurk whole armies of invisible enemies of human life, inhabiting that vast and mysterious underworld we call disease, and watching always for a chance to gain ingress to our bodies. We speak of these microscopical despoilers as bacteria, which by the use of a little imaginative license we may endow with attributes of crafty intelligence, ever



eager for the deadly contact with human kind that will give them entrance to the blood stream through mucous membranes, pores, or skin abrasions, or, with greater cunning, by way of the hair follicles.

**B**ACTERIA, indeed, would speedily destroy us and wipe out human and animal life except for a mystifying force within ourselves known as "natural immunity." This is a wonderfully fascinating subject, about which little was known until comparatively recent times. But when biologists began to unlock the secrets of natural immunity they not only revealed a new and unsuspected world, but discovered strange possibilities for the treatment of disease.

They found that natural immunity was a tangible force, lying largely in the



#### Unsung Hero

Injecting diphtheria toxin into one of the wonderful horses that produce the life-saving antitoxin in their blood

ability of the body cells to produce antitoxins and other substances with which to repel the attacking enemy, bacteria. These discoveries were pivoted on studies of the body cells.

Without going far into the realms of fancy, we can say that every human cell is virtually an animal in itself, and that the human being is made up of vast colonies of these cell animals. Some of them are working to build and maintain the body. Others, known as the "white cells" or "leucocytes," or sometimes "phagocytes," are wandering cells, with power to elongate and propel themselves from one point of the body to another, passing through the tissues with a peculiarly penetrating power. The phagocytes are among the chief fighters of disease germs, which they devour. With a powerful microscope they can be seen in motion, carrying fragments of bacteria.

To accomplish the overthrow of the bacteria and reduce them to a form in which they can be digested by the phagocytes, the body cells produce and throw off into the blood a mysterious something, possibly chemical substances,

#### The Rescue Trail at Nome

From Anchorage the 20-pound package of life-giving serum was carried by rail 300 miles to Nenana. The remaining 660 miles to Nome were accomplished by dog teams in 5½ days



#### A Magic Weapon Against Plague

This little bottle contains 10,000 units of diphtheria antitoxins, sufficient for one treatment. Thirty times this amount was carried in the dramatic dash over the snow to Nome, where 27 persons lay sick of the dread disease

which scientists call "antibodies." These antibodies never have been identified as visible entities. Just what they are remains to be discovered; but although they never have been seen, their presence or absence can be ascertained positively. Just what antibodies will do is known to a certainty. Every different form of disease, moreover, is combated by its particular antibody in the blood.

Every person in normal health has enough antibodies in his system to destroy a reasonable quantity of almost any sort of bacteria. This is natural immunity. When an unusually large quantity or especially virulent type of bacteria gains access, or when the subject is weakened or even temporarily exhausted, the natural immunity is overcome and disease gets the mastery.

**S**O SCIENCE, as represented in the fields of medicine, bacteriology, and biology, has discovered by extraordinary experiments how to produce antibodies artificially in the blood of horses or other animals, and how to separate and purify the serum containing the antibodies after it is drawn from the blood stream of the animals, making it safe for injection into the blood of persons suffering from infectious diseases.

At Glenoben, Pa., not far from Philadelphia, I saw recently a herd of wonderful horses, which are devoting their lives to growing in their blood these mysteriously invisible, yet tremendously real antibodies. These horses haul no drays and drag no plows, but live in equine luxury, protected by every sanitary device, fed on the choicest of stable provender, groomed and petted and exercised as the aristocratic horse should be; all because their blood streams are the garden soil of science. Without suffering or inconvenience they produce, through nature's own miracle, the very substances





Leonard Seppala and his Siberian huskies which bore the brunt in Alaska's most dramatic race against death. Togo, Seppala's famous lead dog, was lost on the journey.

that we ourselves produce in our own blood, in normal health, to crush or poison invading microbes of death.

These horses receive at first minute hypodermic injections of killed bacterial cultures or their poisons. This immediately arouses the animal cells to produce antibodies. Gradually the doses are increased, and at last the horses are painlessly bled. The serum is refined, tested for purity, safety and activity, and then bottled.

**IT WAS** these very horses that supplied most of the antitoxin rushed over the snows to relieve disease-infested Nome.

It was these very horses that, only a few months earlier, supplied the serum that checked the outbreak on the Pacific Coast of the now rare pneumonic plague, the black death that killed millions of people in the fourteenth century.

In the foreign section of Los Angeles a woman died from a strange and galloping disease, and of those who attended her funeral nearly all met with a similar fate. Los Angeles turned to medical science for the identity of the dread invading germs, and the answer was quick and positive.

Rare though this diabolical disease has become in modern times, the biological laboratory in Philadelphia, which I have mentioned previously, had an anti-plague serum actually in stock, awaiting the possible call of emergency. Within an hour after the transcontinental telephone brought word to the laboratory of Los Angeles' need, 500 doses of the serum were packed, and an automobile was off for a flying-field near New York. Speed records were broken, and the air mail carried the only known remedy to the Western Coast in a couple of days. As a result, the invisible enemy was put to rout. The quarantine was raised in a few weeks, with the death count less than 40.

**THRILLING** incidents such as this, and the more recent race with death across the Alaskan snows, of course are infrequent in the war that science is waging against destructive bacteria. Yet it is such a gigantic struggle that its underlying dramatic elements are unescapable.

It is a wonderful warfare, according to Milton Campbell, president of the H. K. Mulford Company, of Philadelphia, to whom I am indebted for most of the material contained in this article. All its forces are directed along ultra-scientific lines, for the saving of human lives. It deals not only with the sick—those actually in the grip of bacteria—but with the protection of millions of persons still

uninfected but moving among the hazards of disease.

The scientific prevention of disease is revolutionizing medicine. Medical men of today are generally agreed that the physician of the future will devote a large share of his skill toward the prevention of infectious diseases, not alone by sanitation, but by actual immunizing of his patients.

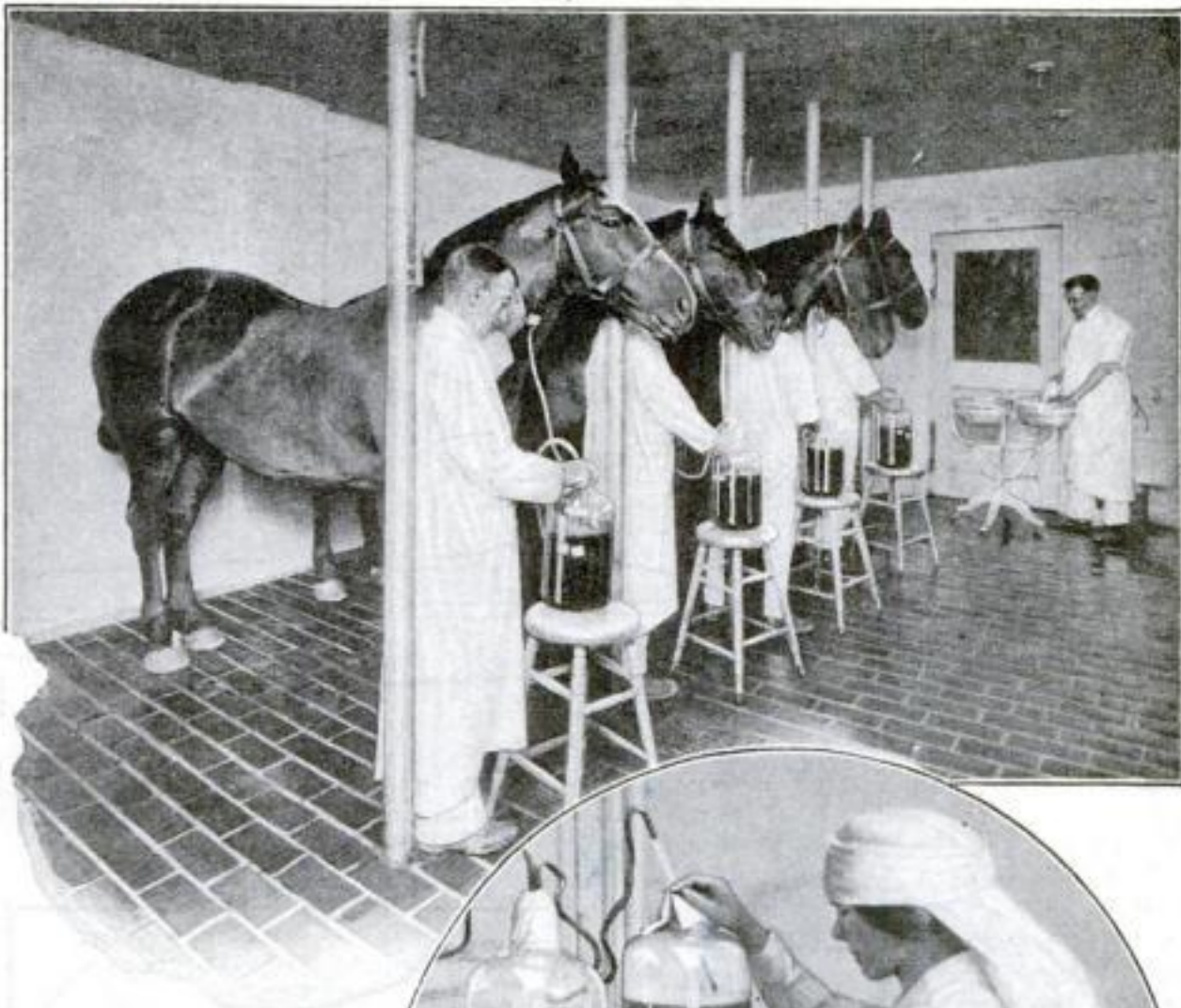
Compare the present and past history of disease and you will be struck by the progress being made in immunology.

is a solution containing the germs themselves, killed; while a serum is obtained from the blood of horses or other animals containing the antibodies produced artificially. It was found that killed bacteria, when injected into man or animals, would arouse the antagonism of the body cells, much as the live bacteria would do, and that the cells would proceed to generate antibodies.

Going a step further, the research scientist made another great discovery—serobacterins, a product containing both antibodies and killed bacteria. The ready-made antibodies attack the disease that affects the patient, while the killed bacteria stimulate the cells to produce natural antibodies.

**WHATEVER** the nature of the virus, whether it be the microbe of plague, dysentery, cholera, typhoid, the virus of rabies, or the toxin of diphtheria, or whether the microbes are killed or living, this process, known as sensitization, confers on them properties that

*(Continued on page 138)*



#### Giving Their Blood

From the blood streams of these fine animals science painlessly draws the priceless serum that imparts immunity

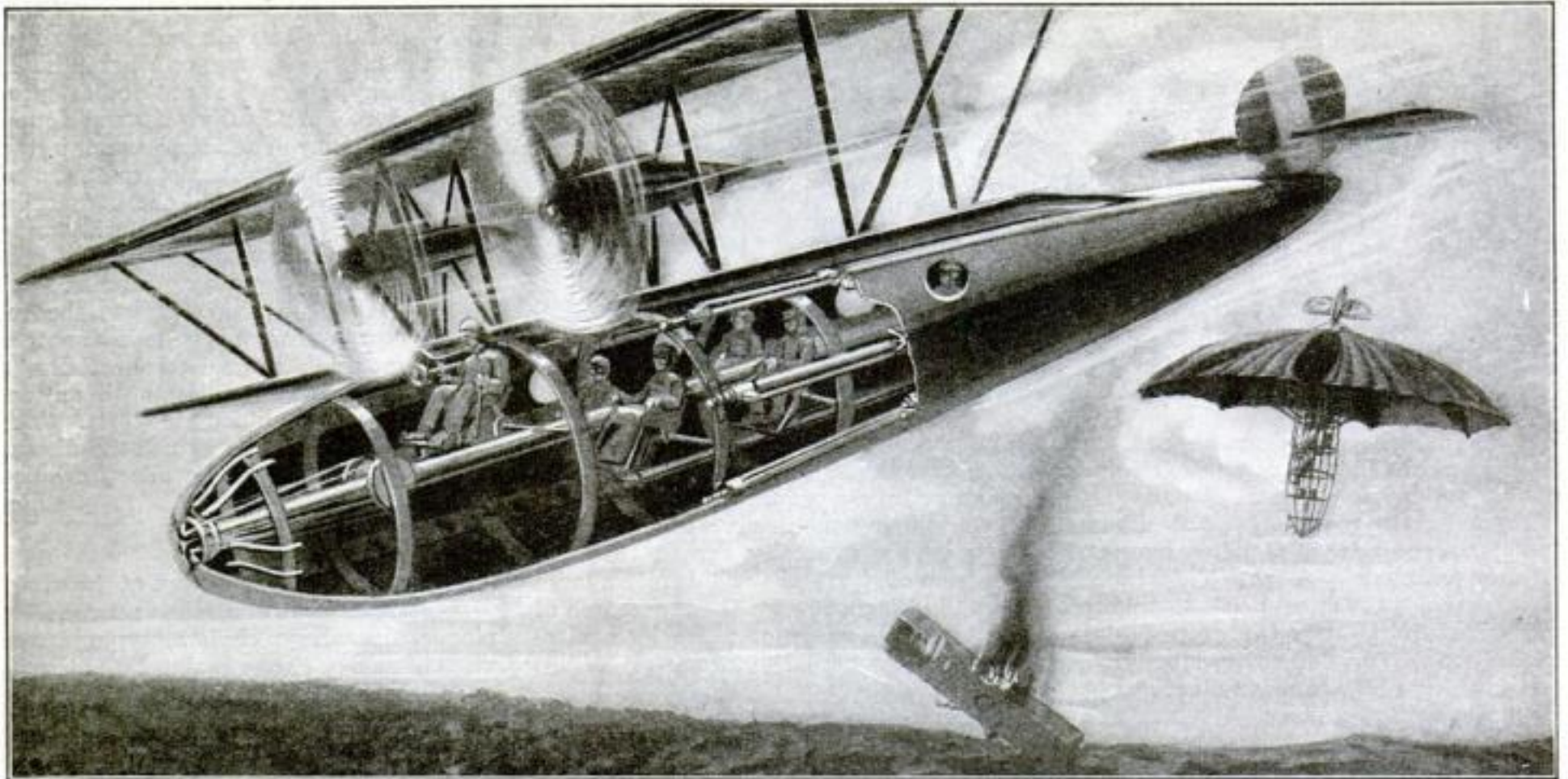
Mortality statistics bear eloquent testimony to the marvels immunology has accomplished with smallpox, hydrophobia, cholera, bubonic plague, and other diseases of the same malignant type.

Two principal weapons are employed by science in the cure and in the prevention of disease by immunology—bacterins and serums. A bacterin



Then, in the laboratory, the serum is separated from the red blood corpuscles and purified to make it safe for injection into the blood of persons, there to crush invading microbes of death





Secure from disaster—How the ingenious airplane-parachute might appear in flight, and as unfolded into a huge umbrella, with wings and motors released, floating safely to earth. Contrast with the plane crashing in flames in the background

# Amazing Plane Its Own Parachute

**I**MAGINE, for a moment, that you are seated in a great passenger airplane, riding across the sky thousands of feet above the earth.

Suddenly comes a sharp explosion. The machine dives dizzily. A moment or two more, you think, and it will be the end.

But at the instant the thought of certain disaster flashes across your mind, the pilot pulls a lever and, to your amazement, the wings, motors, gasoline tanks, and propellers fall away from the streamlined fuselage. Simultaneously, as the wingless car plunges in a nose dive, the rounded sides of the fuselage itself begin to open outward in segments, like orange peel. In the rush of air, these segments, joined by webs of strong canvas, and all hinged to a center shaft at the rear, quickly open wide to form a gigantic umbrella.

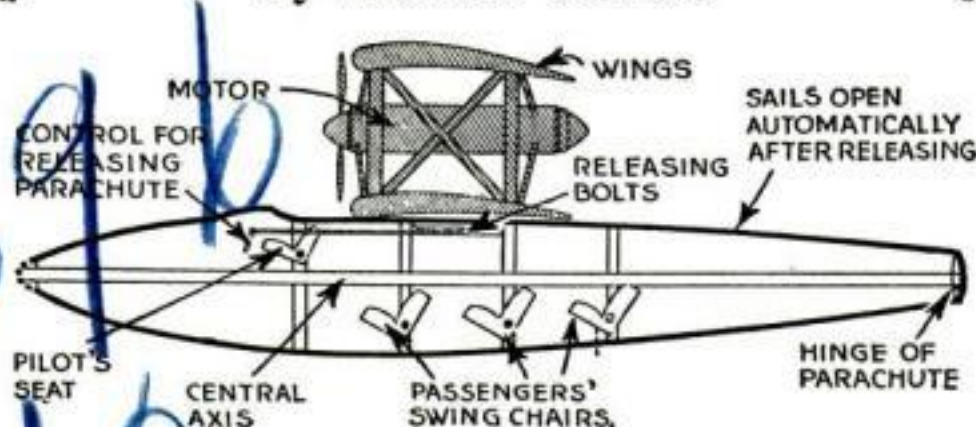
**I**NSTEAD of crashing to almost certain death, you find that you are still riding easily in the same comfortable chair. The breathless plunge downward has ceased. Now you are floating earthward gently under the dome of a giant parachute.

Just such a combination airplane and parachute, amazing in its conception, yet astonishingly simple in design, is the recent invention of Captain Lepinte, a French aviator, who has gained distinction for the production of several other safety devices for airplanes.

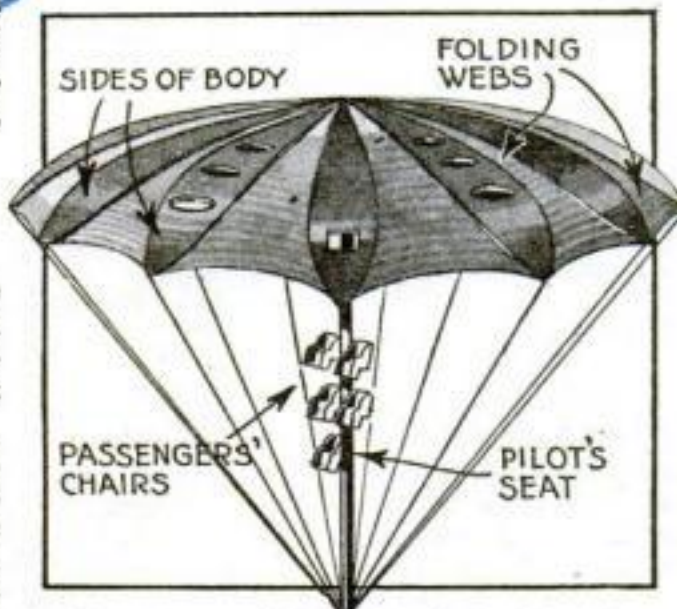
Stripped of its superstructure, the flying machine is an immense folded parachute in itself.

*In Emergency the Wings Drop off and the Body Unfolds*

By Truman Stevens



Design of the machine. The shaded portion represents the wings, power plant, and gasoline tanks, all released by a control lever in the pilot's cockpit. The same lever simultaneously releases the parachute



How the sides of the airplane body, joined by canvas webs, open to form the parachute. Notice how the passengers' seats, pivoted on the center shaft, swing automatically to an upright position as the nose of the machine points downward after the parachute is freed

The secret that lends practicability to the invention lies in the manner in which the separable parts are held together so that they can be released almost instantly. The fastenings are screws with interrupted threads, which may be locked together or unlocked simply by one-eighth turn of the screw. The entire mechanism for releasing all the various fastenings is controlled by the pilot in a single operation.

**T**HUS, simply by swinging the handle of a lever, the pilot can separate the wings, motors, and propellers from the fuselage. The same movement releases the segments of the

fuselage covering that open outward to form the parachute. The complete release requires not more than a few seconds. To prevent the big umbrella from turning inside out, wire stay ropes connect the outer rim of the parachute with the nose end of the center shaft. Danger of the plane's catching fire after an accident in the air would be obviated by the release of the fuel tanks.

An interesting feature of Captain Lepinte's invention is the manner in which he provides that the passengers shall remain seated upright in their chairs even when the nose of the car is pointed downward. He has designed the seats so that they are attached by pivots to the center shaft of the fuselage. Thus, whatever angle the fuselage takes, the chairs always swing to an upright position.

Captain Lepinte estimates that the car would descend with a velocity of not more than nine feet a second.



# Airplanes Hurled to Bits in Test

## Terrific Crashes Against Wall Show Faults

By Newton Burke

**W**ITH crashes that echoed through the surrounding country for miles, four airplanes recently were hurled to destruction down an incline and against a concrete wall at Wilbur Wright Field, Dayton, Ohio, in a spectacular test conducted by Army Air Service engineers to ascertain the principal structural weaknesses of aircraft and to determine the causes of airplane collapses, as well as explosions and fires in fallen planes.

The four planes selected for the test were old and of obsolete models. The wings were removed to prevent the planes from rising. The machines were sent away separately from a concrete platform 25 feet high, from which an inclined track led to a concrete wall 100 feet away. Each plane was lashed to the track, and its main gasoline tank and the gravity tank on top of the fuselage were filled with 100 gallons of gas. Then the motor was started, the throttle was thrown wide open, and the rope that held the craft cut with an ax.

Immediately the plane plunged forward. Gathering momentum with each revolution of its propeller, it attained a speed of more than 100 miles an hour before it reached the bottom of the incline. The crash heard as each plane in turn struck the thick wall of concrete was terrific. Bits of wood and metal were cast high in the air. In one case a small sliver from a propeller rose 1000 feet in the air and fell 100 feet away. A spray of gasoline drenched photographers and en-



Headed for Destruction—One of the four pilotless test planes at the top of the incline, just before plunging downward and crashing into the concrete wall seen in the distance

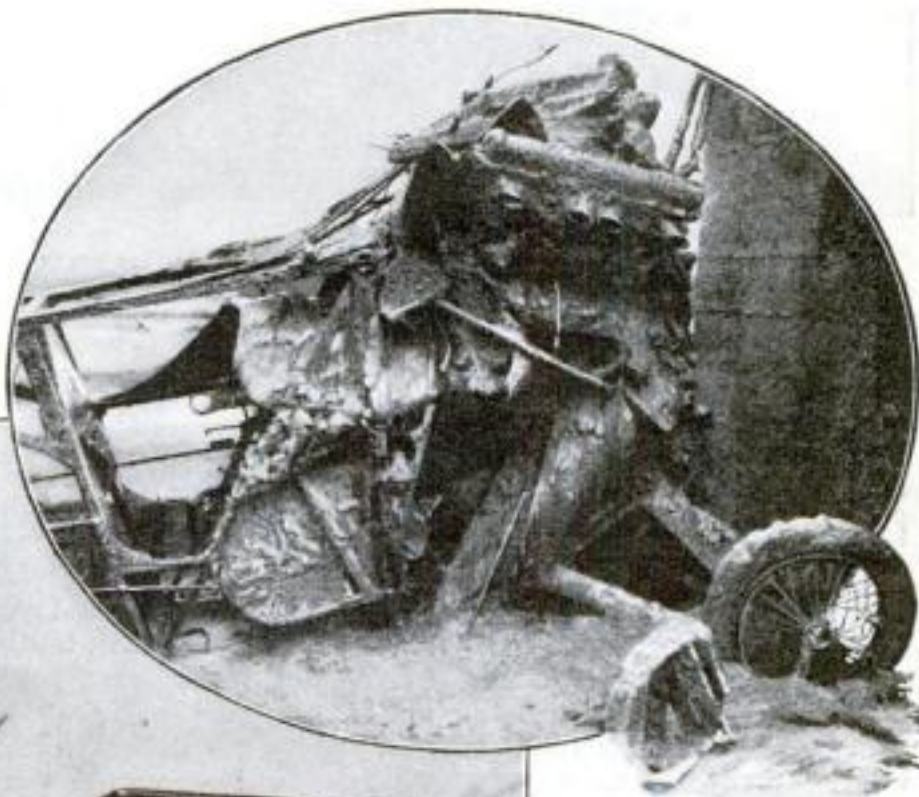
gineers who were watching the demonstration from shelters 25 feet away.

In each case the propeller shaft embedded itself in the concrete to a depth of about a foot. The frail propeller was reduced to splinters. Each plane rebounded slightly from the wall, then crumpled into a shapeless and shattered mass of metal.

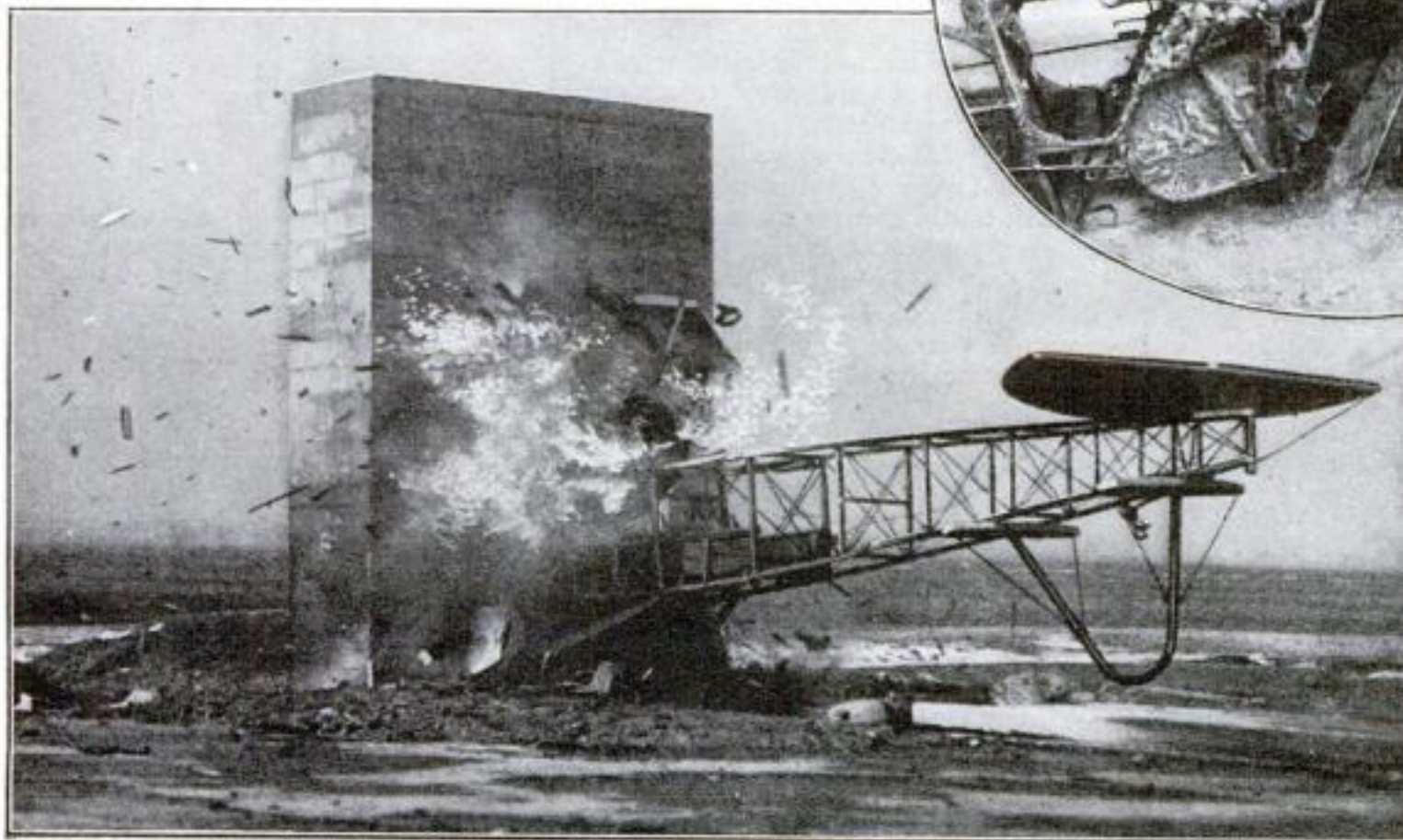
In one respect the test failed of its purpose—no plane caught fire or exploded. Army engineers stated afterward that the cause of fire and explosion in planes that have crashed to earth is highly mysterious. Usually, though, it occurs in planes that have descended in a nose dive.

Crashing in this position causes the entire structure to be deluged with gasoline, thus readily starting a fire if sparks occur. This method of descent was not reproduced in the tests, the runway down which the planes sped being inclined at a comparatively small angle.

The army engineers are not yet ready to announce the results of the tests regarding structural weakness of aircraft.



The Crash—and What Was Left



In the tremendous impact between speeding plane and thick concrete wall, splinters of wood and metal were flung high in the air. A shower of gasoline drenched the photographer who took the remarkable picture at the left. The thunder of the crash was heard for miles. The plane rebounded slightly, and crumpled into the shapeless mass of metal shown above



# The TAMING

How this terrible giant has  
It lifts huge mountains and

*By Robert*



**Blasting a River Channel—A Man-Made Geyser**

Dynamite now can be put to work in water as well as in earth or rock. This spectacular photograph shows how tons of water were hurled a hundred feet in the air during the blasting of a channel in Cotee River, near Port Richey, Fla. The completed channel, 20 feet wide and seven feet deep, connects the Cotee River for navigation with the Gulf of Mexico.

**S**EVENTY thousand pounds of dynamite—enough to blow up New York City if carefully placed—went off one day down in the mountains of Virginia. With the touch of an electric button a mile or two away, the detonating spark darted with incredible speed through hundreds of auger-like borings in the vast pile of rock and earth, touching the metal caps embedded in thousands of dynamite sticks. With a single impulse these chemical contrivances let loose their titanic force, lifting the whole mountain from its base and toppling it over into a deep gorge adjacent.

Thus the mountain, upside down, formed the foundation for a great dam—a structure that would have required enormous masonry work otherwise, far down in the depths of the canyon.

On the lowlands not far from this somersaulted mountain, I stood the other day and watched a crew of men place dozens of dynamite sticks in the ground in a straight line, perhaps six or eight feet apart. Dynamite sticks are round and

innocent looking, as thick as two fingers, and a few inches long. They look like compressed sawdust, stuck together with molasses, maybe.

Why the sticks should be put in the ground in such a way might not be apparent to the casual observer; but presently there came a quick staccato

noise, as if a row of soldiers in some hidden trench had fired their guns almost in unison. Along that straight line where the sticks of dynamite had been, a great upheaval of dirt rose perhaps 10 or 15 feet, falling in a dusty shower.

And then, when the cloud had settled, there was revealed something almost magical. Where the line that marked the dynamite had been lay a ditch, four or five feet deep and wider than that at the top—a drainage channel almost as neatly dug as if a hundred laborers had toiled for days with picks and shovels.

Long-time research work has made it possible within the last year to do things of this sort, along highly specialized lines. Scores of scientifically trained men spend their lives prying out of science explosives of kinder disposition but of greater capacity.

To learn something about these men and their work, I went to the experimental station of E. I. Du Pont de Nemours & Company near Wilmington, Del., and there Dr. C. M. Stine, Director

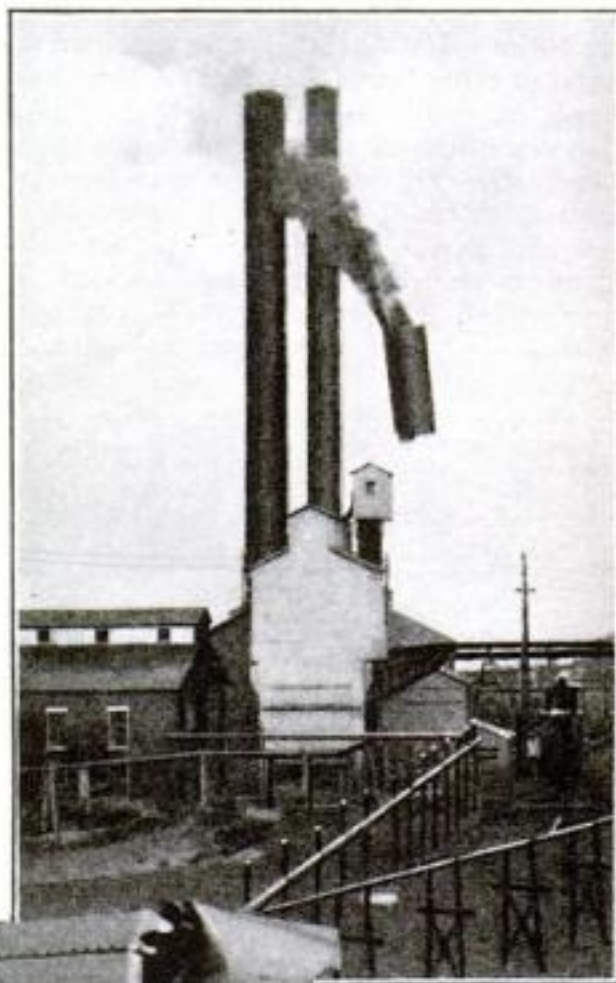
of Chemical Research, showed me some of the magic that modern research has wrought in taming high explosives for the every-day uses of man. He showed me how amazingly the giant dynamite has been harnessed to save time and labor.

"Vast improvements have been made in commercial explosives within the last 20 years," Doctor Stine told me, when I referred to the ditch-digging job I had witnessed.

"**Y**OU may think that dynamite works fast in this sort of excavation," he said; "but relatively the time required for the wave of explosion to run along the line of the ditch is long—maybe a good fraction of a second.

"The control of the speed of explosion is an important phase of the work with dynamite. It may seem grotesque to say that dynamite may be slow or fast. But apparatus has been devised for measuring the rapidity of explosion where the velocity is three or four miles a second.

"To the every-day spectator the whole



**How Dynamite Cut Off a Chimney Top**

Clipping a five-ton section from the top of a steel stack at Gibbstown, N. J., was accomplished recently with dynamite almost as

neatly as if it had been sawed off. The upper picture shows the falling section in midair. Below: How it looked when it struck the earth



# of DYNAMITE

been put to work for us—  
cuts wood into stove lengths

## Bracefield

series of explosions seems almost simultaneous. To the research chemist, however, the difference in speed is of great importance. He can quicken the wave or slow it down as he pleases."

Doctor Stine described recent progress in removing the danger of handling high explosives in large quantities, citing the fact that in New York State is a seven-mile ditch dug cooperatively by farmers with dynamite.

"IN THE old days," he reflected, "you recall reading of the laborer who exterminated himself while thawing dynamite. The elimination of the necessity for thawing, through the production of a non-freezing dynamite, is one illustration of the work the scientist has accomplished. In the iron-ore country, non-freezing dynamite now is used at 30 degrees below zero."

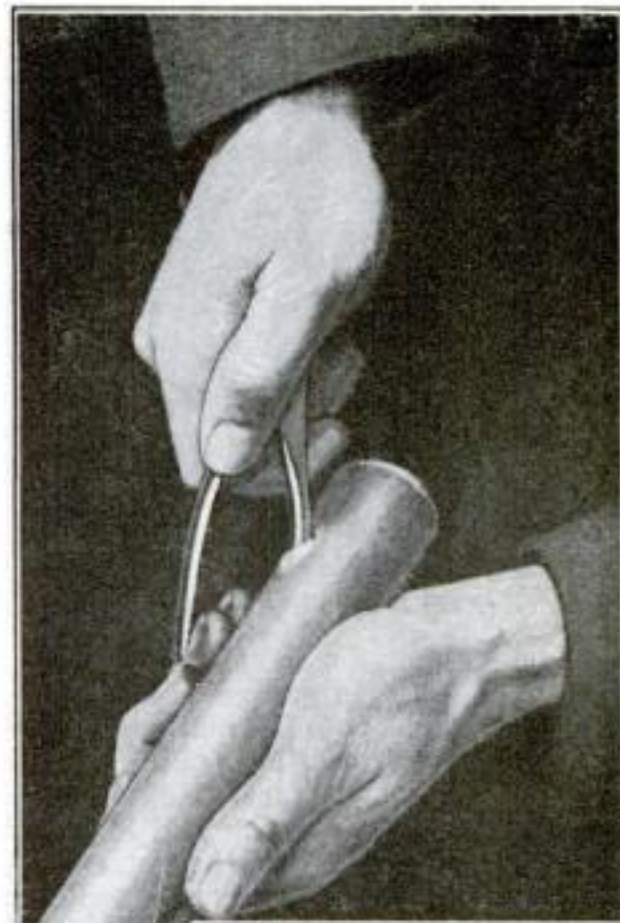
Out on the highways of the Rockies next month, automobiles will get through with ease, where in former years motor traffic was often impossible before June, or even July. The modern method of opening such roads is to bore into the dense mass of ice and snow and break it up—with dynamite.

In the same manner ice jams in the rivers are blasted. In northern New York State not long ago a huge mass of ice formed above a large paper mill, and the impounded waters menaced the plant. Dynamite was shipped in response to a telegram, and the ice was dislodged in a day.

Quite as spectacular is the blasting of log jams that not only threaten to flood whole regions,

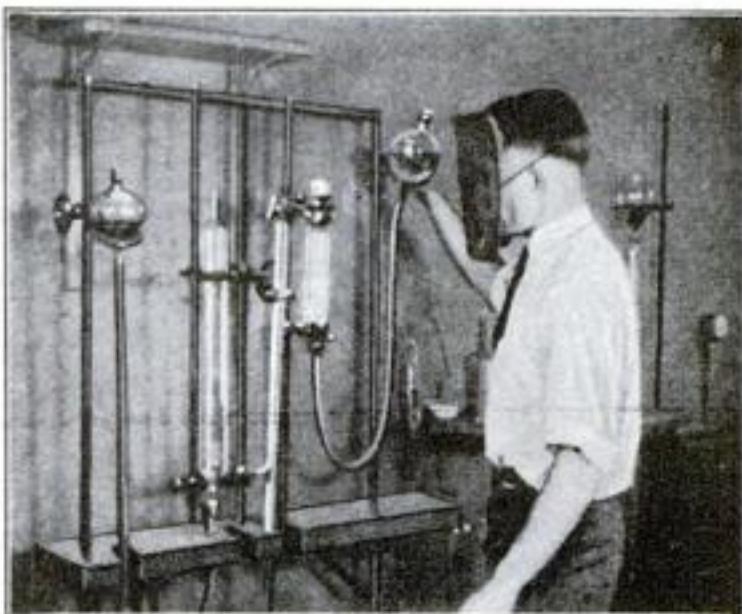
but prevent the logs from floating to the sawmills. Here again dynamite comes to the rescue. It always lets loose the barricade.

In ordinary wrecking jobs, too, dynamite now does, in a few seconds, the work that formerly required days. In a college town, not long ago, a towering old brick smokestack alone remained of an erstwhile factory. For years it had disfigured the college settings. At last the contract was let to have it taken down brick by brick—but a dynamite contractor offered to remove it at a small fraction of the price involved by the other method. Beginning with small charges near the base and gradually enlarging the opening, he felled the huge chimney as accurately as the woodsman fells a tree, along a given



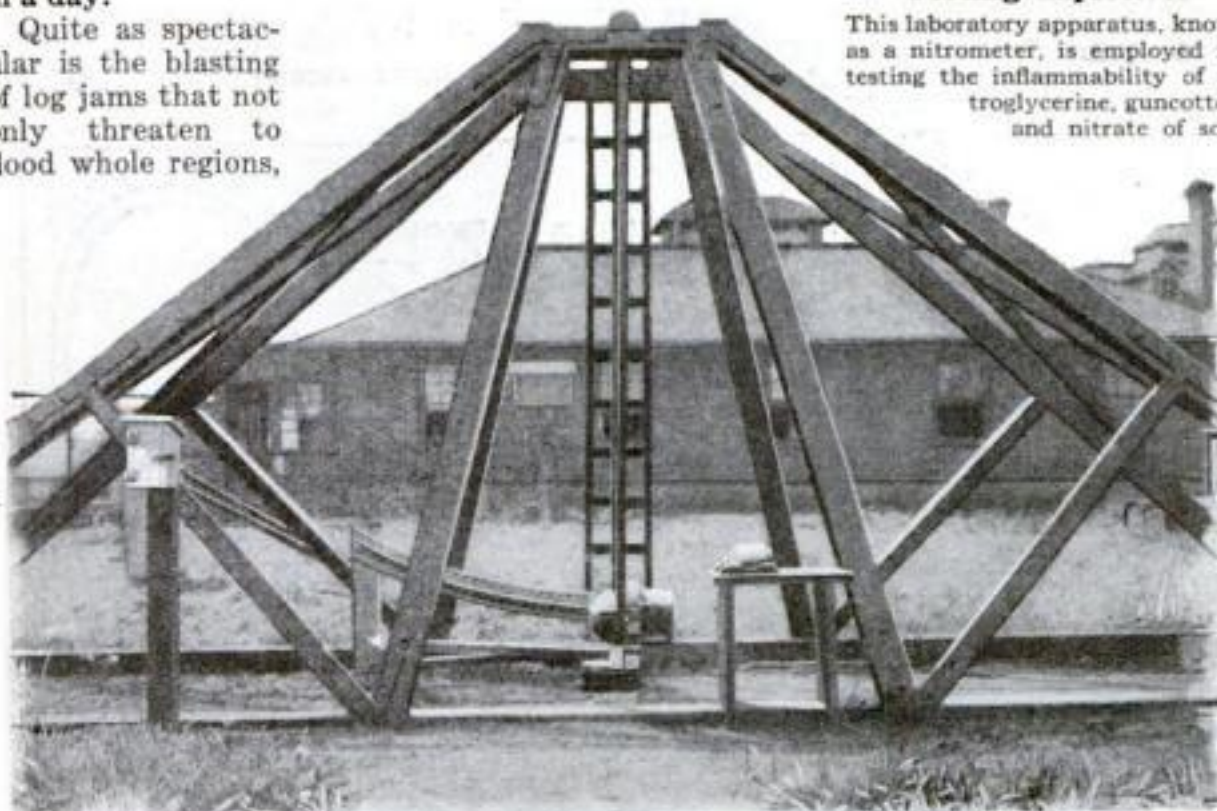
Safe to Handle

Most of us think of dynamite as something extremely dangerous to handle. As a matter of fact, experts can cut it, scrape it, burn it, and even drop it without its exploding. Thousands of tons of it are transported every year by railroad, wagon, and motor-truck



Testing Explosives

This laboratory apparatus, known as a nitrometer, is employed for testing the inflammability of nitroglycerine, guncotton, and nitrate of soda



How the Force of Dynamite Is Measured

Another testing apparatus, the ballistic pendulum, measures the explosive force of dynamite. The percussion is made to act against the ball

of a pendulum, causing the pendulum to vibrate. The amount of vibration then is measured on a calibrated arc, registering the force expended

line. So close was the reckoning that it had to graze one of the college buildings in its descent.

Quite kindly is the dynamite that cuts from the hillside slices of white or polychrome marble. Once upon a time the individual workman quarried these slabs with infinite labor. But now small charges of dynamite are inserted along an indicated line and exploded simultaneously, with a gentle dynamic tap. Yet it cuts out the slabs as neatly as the old-time quarryman could do it.

Almost benign also is the dynamite used for tree planting.

"On one occasion," Doctor Stine told me, "a group of women gathered for this purpose, and not knowing that dynamite was to be used they stood about the workmen as the sticks of explosive were cut in pieces. They began to inquire what the stuff was, and fled in disorder when they found out."

"WHEN the dynamite was placed in the hard soil and exploded, there was just a murmur and a tiny upheaval of earth over each charge. But the soil was loosened far down into the ground. Not only was the planting accomplished with ease, but the young roots had every chance to grow easily."

"This particular use of dynamite has become widespread, in the setting out of orchards, for example. Moreover, extraordinary results are on record where orchards had practically ceased bearing and were rejuvenated through the loosening of the soil with dynamite."

"Dynamite is an adjunct of farming in cut-over regions, where whole fields are freed from stumps in a few days. Contractors go even further and split the wood





How a 100-year-old farmhouse was completely razed by a dynamite blast. Only a stone pile remained

into stove lengths at the same time. In Florida a large grower of vegetables found his whole crop in imminent danger of ruin by water that backed up over his land after torrential rains. He called in a dynamite contractor, who told him that the small ridge that held the water could be blown away and the crops saved, but that the rush of water probably would carry away a small bridge over a creek below. The grower guaranteed to replace the bridge—and the job was done in a few hours. His crop was saved.

"Subsoiling via the dynamite method is now widely employed. Twenty million pounds of explosives are used every year for agricultural purposes.

**I**N MINING, of course, explosives play an exceedingly important rôle. Here, though, their use in the past has been surrounded with hazards that have presented extremely difficult problems. If you could watch the dynamite research men in their investigation of these mine problems, you would find a huge steel chamber, called a "gallery," which duplicates the dust and other conditions in the mines. This atmospheric content of the mine has been scientifically manufactured and let loose in the gallery.

Now watch the dénouement. With the gallery sealed and the scientists watching the indicating devices at a safe distance outside, a tiny spark is flashed over a wire, and the muffled explosion in the chamber exemplifies the actual blasting underground. Now the scientific apparatus measures all the gases exuded. Of course, the problem is to manufacture explosives that will cut down toxic fumes to the minimum.

"All through the experimental work with dynamite has run never-ending research to make this explosive safer," Doctor Stine told me. "To start with, we had the treacherous nitroglycerine, an oil that had a habit of exploding on the least provocation. It was once used in large quantities despite its terrible disposition—particularly in the oilfields. Specially designed

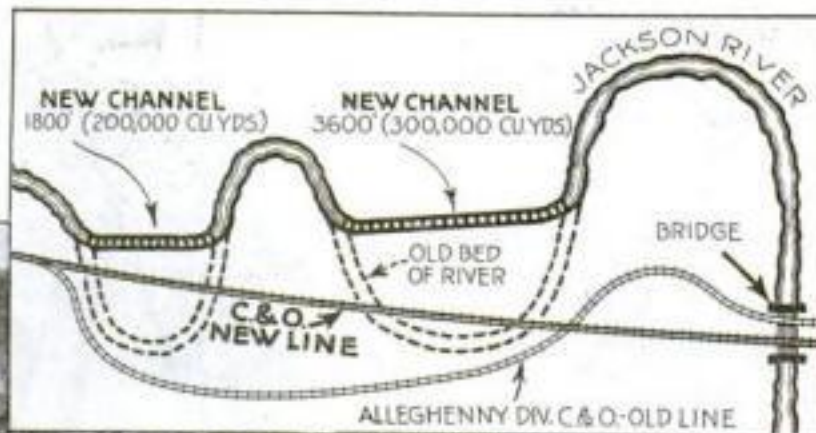
wagons transported it, with all sorts of cushion arrangements; yet not infrequently serious accidents resulted.

"Today this same nitroglycerine, with all its old appalling force, has been harnessed into the compound called 'dynamite,' so you can cut it, scrape a hole in it, burn it, or even drop it. The explosive is



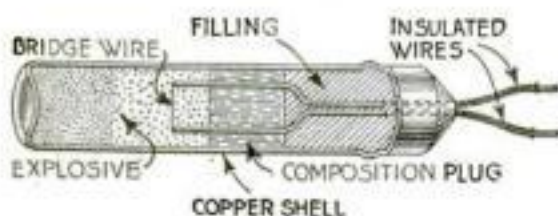
Felled by Dynamite

Dynamite charges set off around the base of this brick chimney chopped it down almost as accurately as a woodsman fells a large tree



Changing a River

The map shows how new channels were dug by dynamite for the meandering Jackson River to provide a straight right-of-way for the Chesapeake & Ohio Railway near Clifton Forge, Va. At the left is an irrigation ditch dug by dynamite. The sticks of dynamite were placed at six-foot intervals



The Detonating Cap

The cap is filled with fulminate of mercury, through which is bridged a metallic filament, finer than a hair. A minute electric current makes this fine wire red hot, firing the charge

transported safely in great quantities on the railroads, and even goes through wrecks without exploding.

"All this has not come about accidentally. It is no mere question of pouring the nitroglycerine into sawdust or some other absorbent, and molding it into cylindrical sticks. A most extensive chemical research has done it. Today the manufacture of high explosives stands twelfth in the list of hazardous occupations.

"Some of the ordinary constituents of dynamite, aside from sawdust, are wood pulp, cornmeal, flour, sodium nitrate or sulphur, combined with high explosive compounds that have been built up in the chemical laboratory with a view to obtaining a chemical molecule especially adapted to industry.

"Much of our advance in producing better high explosives is due to scientific control of the chemical reactions of complex chemical compounds. Large-scale chemical reaction is no longer a matter of individual judgment. The rate of mixing ingredients, the quantities and the temperatures and pressures are controlled to the fraction of a degree. Mechanical devices make the manufacture as fool-proof as possible.

**T**HEN, after all other problems have been considered, the research man is called upon to produce dynamite on a commercial basis. It must be made cheaply enough to be marketable. In his search for cheaper high explosives, he has competed with nature in the synthesis of the raw materials that constitute the starting point in high explosives. For example, the glycerine forming the basis of many nitrated compounds used in dynamite is usually obtained as a by-product of soap. The research chemist has perfected methods for producing artificially a glycerine identical with that occurring in the animal fats.

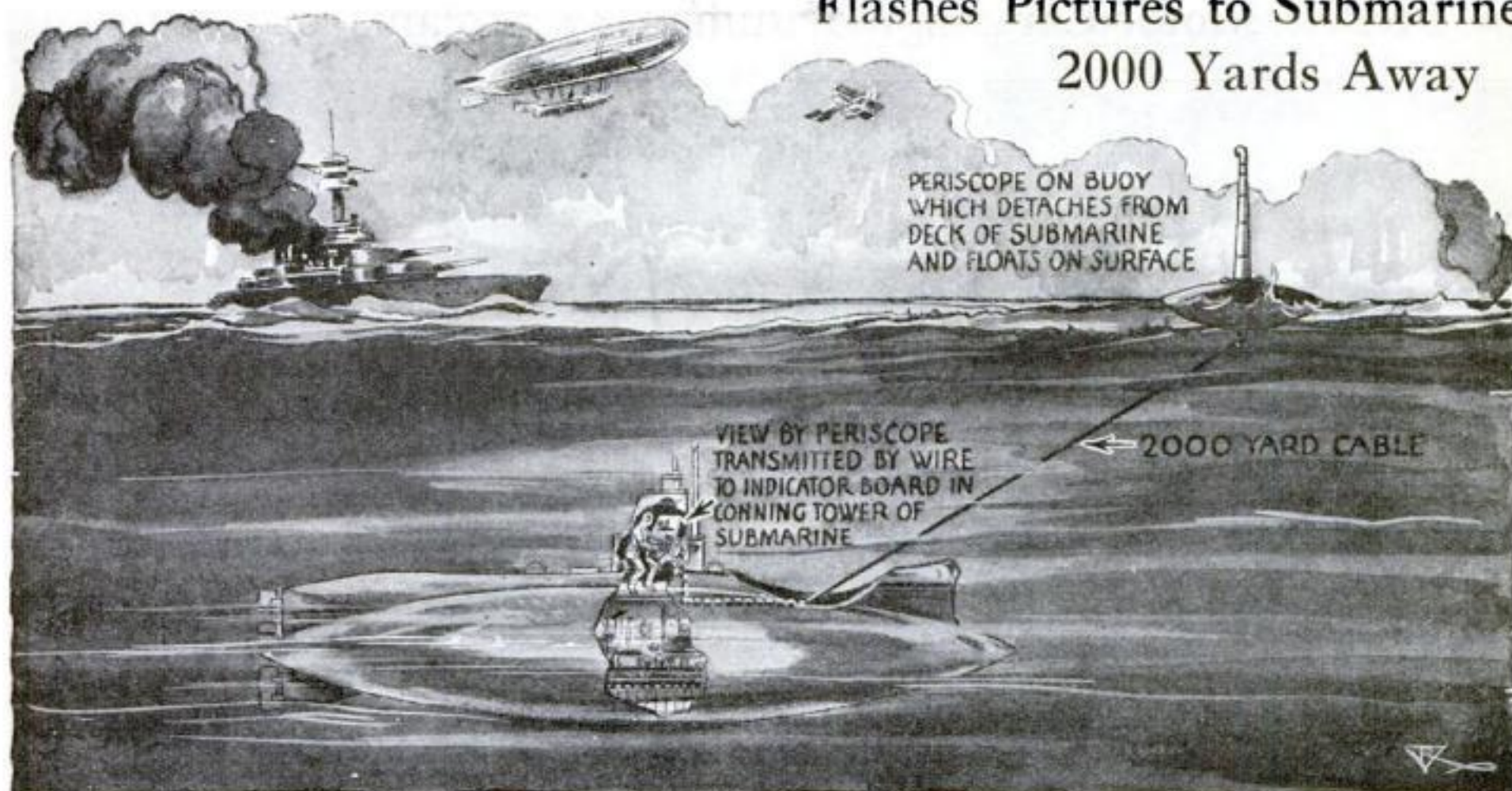
"Sometimes sugars are used in making

(Continued on page 143)



# New Buoy Periscope Sees and Hears

## Flashes Pictures to Submarine 2000 Yards Away



Instead of being an integral part of the submarine, Dr. V. A. Clarke's ingenious electric periscope is mounted on a buoy, which floats 2000 yards from the conning tower when an observation is being made.

When not in use, the device is carried in the superstructure. Pictures and sounds of approaching vessels or airplanes are transmitted electrically to the observers over a copper cable, which also controls the buoy.

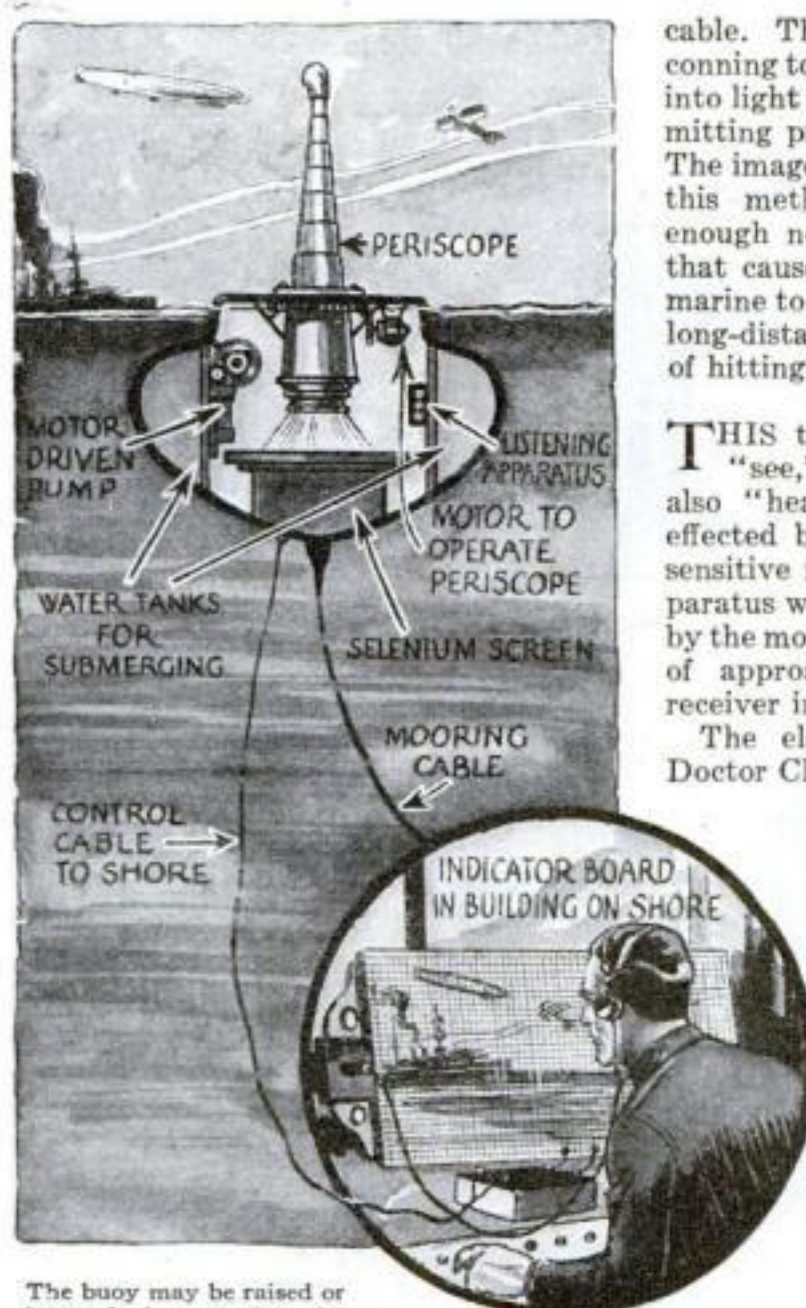
**A**N AMAZING new type of periscope, which floats on the surface far away from the submarine and carries to the latter views of the surrounding sea by means of principles similar to those employed in the radio transmission of pictures, has just been taken under consideration by the U. S. Navy Department.

The periscope is the invention of Dr. V. A. Clarke, of New York City. Its purpose, of course, is to permit a submarine to observe without the possibility of detection by surface ships. According to the inventor, the device doubles the efficiency of a submarine.

The periscope is mounted in a cigar-shaped buoy, about 12 feet long and three feet wide. When the submarine is under way, this buoy fits into a compartment in the superstructure. When an observation is to be taken, the buoy is released, and is towed at the end of a copper cable 2000 yards long.

Electric controls in the conning tower of the submarine permit the periscope to be raised or lowered by varying the water ballast of the buoy by pumping. Other controls operate an electric motor by means of which the device may be rotated through 360 degrees. At 14 feet, its maximum elevation, the periscope's radius of vision is said to be 11 miles.

**B**ENEATH the periscope tube is a series of selenium cells connected with a sort of radio transmitter. An image of whatever the periscope "sees" falls upon these cells, and the variations of light intensity due to the shadows and high lights of this "picture" cause corresponding variations in electrical impulses that pass to the submarine through the copper



The buoy may be raised or lowered by varying its water ballast. At its full height, 14 feet, the range of vision is 11 miles. A microphone and amplifying device transmit sounds to the submarine or to a station on the shore, adding greatly to the submarine's efficiency.

cable. These impulses are received in the conning tower, where they are reconverted into light waves by a reverse of the transmitting process, and viewed on a screen. The images produced in the submarine by this method are said to be accurate enough not only to identify the objects that cause them, but to enable the submarine to fire upon ships seen through the long-distance periscope with every chance of hitting the mark.

**T**HIS type of periscope not only can "see," according to its inventor, but also "hear." The latter operation is effected by supplying the device with a sensitive microphone and amplifying apparatus whereby sounds such as are made by the motors of airplanes or the propellers of approaching ships are heard in a receiver in the conning tower.

The electric periscope, according to Doctor Clarke, would insure safety to the occupants of a submarine by guarding the craft against attack by enemy vessels. If the observer found the periscope surrounded by hostile ships, he would cut the cable connecting it with the submarine, and leave the periscope behind as a blind while the submarine escaped. Doctor Clarke also asserts his invention might be used as an automatic sentinel to warn coast-defense fortifications of coming attack from the

sea. His device, he states, can be built complete for about \$15,000. The ordinary telescope type of periscope costs between \$8000 and \$12,000.



# Newest Weapons for Fire Fighters

## French Motor-Car Engine Pumps 24 Streams of Water



### All from One Engine

This spectacular photograph shows firemen in Paris demonstrating the latest fire-fighting equipment. Twenty-four streams of water are being pumped from the Seine River by the recently devised single engine shown at the bottom of this page. Paris claims to have the world's most effective fire-fighting system.

### Protected from Smoke

Paris firemen are equipped with a new type of mask that is said to afford complete protection from smoke and fumes.



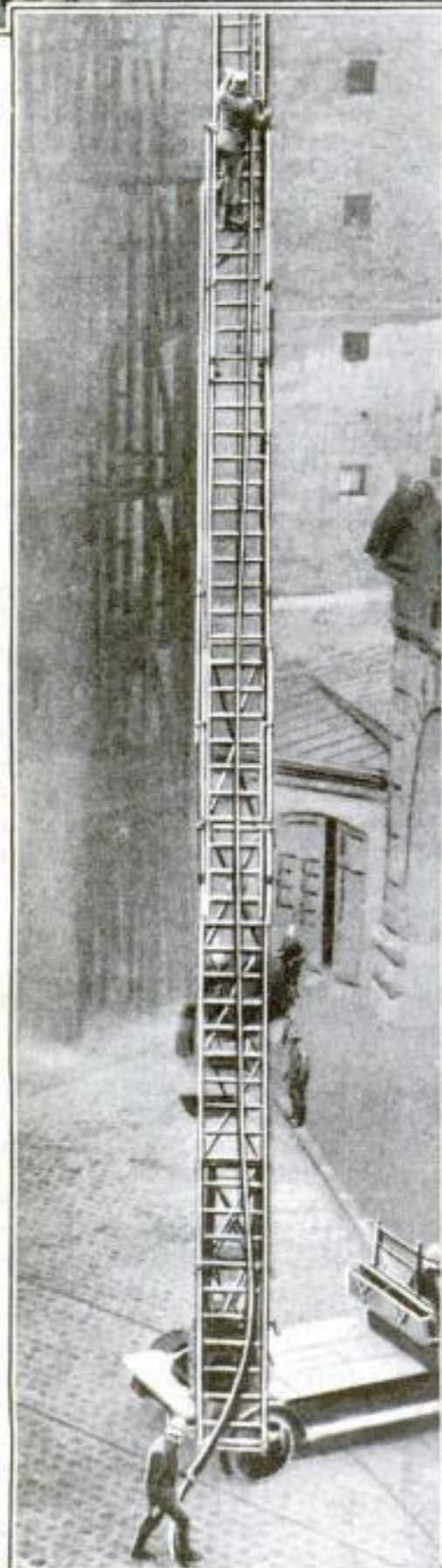
### Trailer Pump

An extremely light and compact pumping apparatus just constructed for rural fire departments in England is mounted on a trailer that can be hauled to the scene of the blaze by any size motor-car.



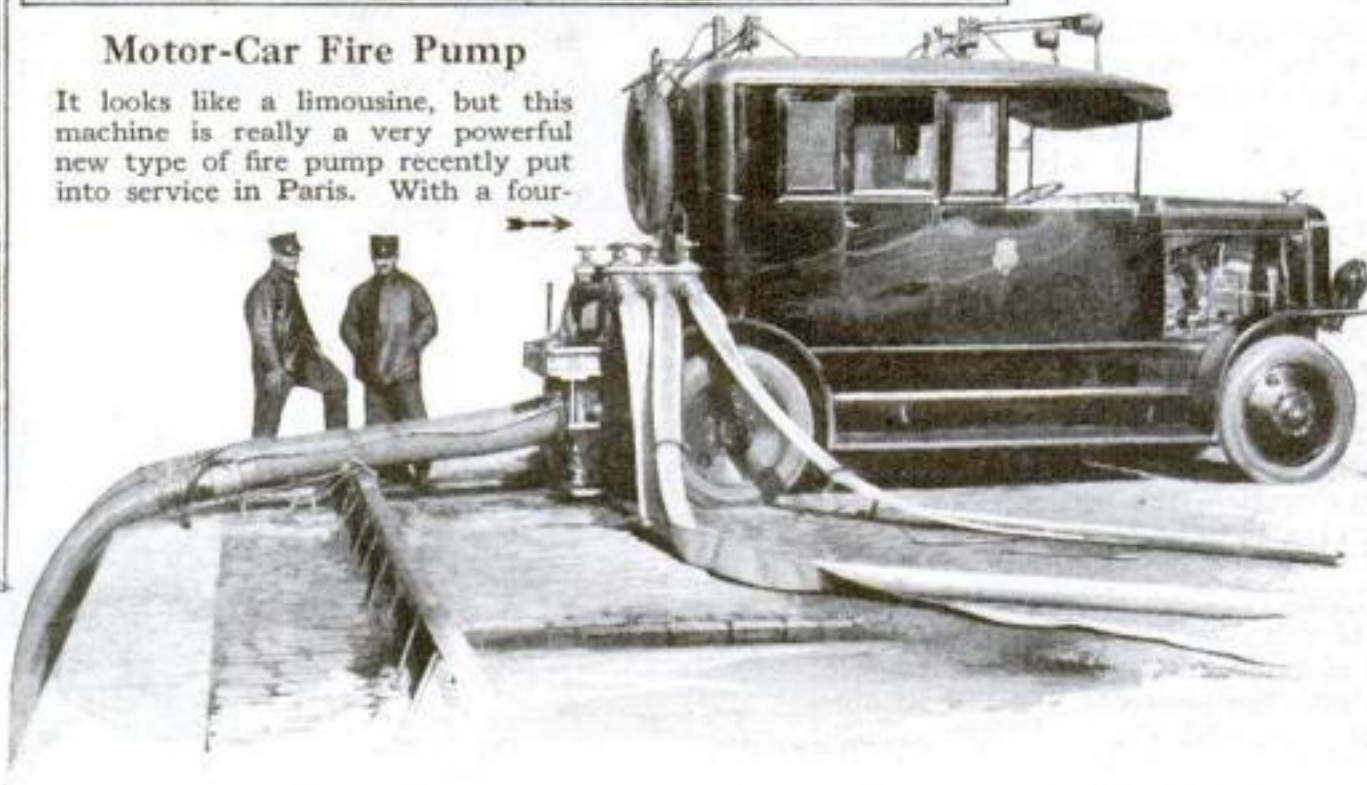
### Motor-Car Fire Pump

It looks like a limousine, but this machine is really a very powerful new type of fire pump recently put into service in Paris. With a four-



### A Dizzy Climb

Among the most important pieces of modern fire equipment, especially in large cities with tall buildings, are the extension ladders. This one, in Paris, rises to a height of nearly 100 feet. This view shows French firemen in action.

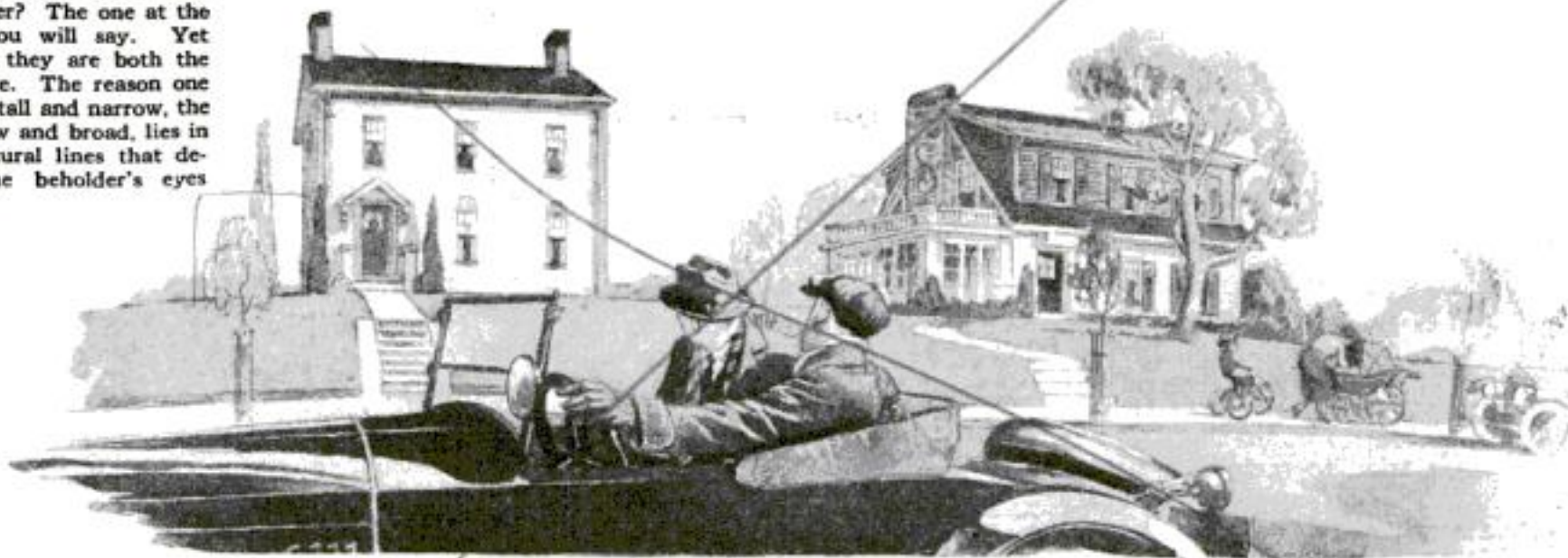


cylinder engine it is capable of delivering 24 high-pressure streams of water. The water is pumped from the Seine River through

the large hose seen at the left of the picture. Notice the battery of hydrants at rear of car, to which the fire hoses are attached.



Which of these two houses is broader? The one at the right, you will say. Yet actually they are both the same size. The reason one appears tall and narrow, the other low and broad, lies in architectural lines that deceive the beholder's eyes



# Do Your Eyes Tell You Lies?

How the tricks of vision can be used to make fat people look slimmer, big feet appear smaller, or to make your home and its rooms more attractive—Try these tests on yourself and see how your eyes can fool you

By Alon Bement

A FRIEND of mine, riding in the country with me the other day, was remarking on two houses set fairly close together by the roadside.

"I wonder," he said, "why the builders didn't make that first house low and broad like the second. See how tall and 'stiff' it looks."

I looked at the two houses and smiled.

"Those houses," I replied, "are identical in size. The difference lies in the eaves, the windows, the chimneys, and the small extension."

Of course he didn't believe me. I actually had to get out and prove to him by rough measurements made across the lot fronts that the houses were the same. It did seem impossible that putting half a dozen low shrubs around a house and cutting an extra sized window (so as to make your eyes run sideways to take in all the windows instead of having them appear as spots) and lengthening the eaves could make a stiff, prim house look so broad and cozy.

But I had studied how to trick the eye and I knew how easily it could be done. I had seen many curious principles put into practice in marine camouflage, principles that we never could have made work if the eye were not fairly easy to deceive. The fact is, the eye can be tricked much more easily and much more completely than the ear, perhaps because the organs of hearing develop earlier than those of sight.

When we are frightened, we instinctively stop and listen. In the dark your eyes are practically useless, but your ear keeps on working just the same. Even while you are asleep your ear keeps guard, a little drowsily perhaps, but awake enough to give you warning before any other sense will. Therefore, within the

Professor Bement, a young American artist, is one of the world's foremost authorities on optical illusions. During the war he worked for the government in camouflaging American ships. He is now director of the School of Fine and Applied Arts of the Maryland Institute, Baltimore.

range of its proper functions, the ear is considerably more to be depended upon than the eye.

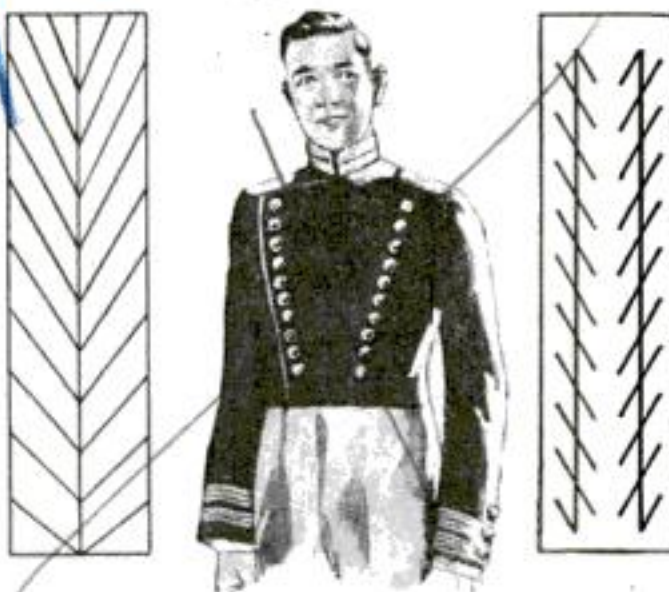
We often are not conscious of the defects of the eye until we begin to consider the matter seriously, but at a very early age we have learned to interpret the illusions that confront us almost without thinking about them.

During the war, one of the earliest discoveries that we made was that we could reduce the visibility of objects on the land by painting them to resemble the objects about them, but when we tried to do the same with ships, we found that it wouldn't work.

The submarine had only to get the ship between it and the sun, and there you were—outlines as clear as anything. Besides that, the atmospheric conditions of the sea change so often and so greatly that you couldn't count on any given condition. You'd paint your vessel to be invisible in a green sea and the ocean would turn gray or purple.

AS IT didn't work, we had to try something else. The next time we went to the opposite extreme. We wanted the ships seen—the more vividly the better. The reason for this was that the submarines did not attack from a distance. When a submarine sighted a vessel, it remained on the surface long enough to get the size of the ship and her exact course, and having made its calculation on where the ship would be in 15 minutes, it submerged and headed under water for the place from which it could attack at close quarters.

We discovered that we could throw out the calculations of submarine pilots by deceiving them as to the direction the ship was taking. When we found that we



How Diagonal Lines Deceive

Fig. 1—Diagonal lines running upward make the rectangle at the left appear to taper toward the top. The perpendicular lines in the right-hand figure seem to converge toward the top. Yet actually they are parallel. The same principle is applied in uniform to make the hips of the wearer appear narrower and, by force of comparison, his shoulders broader

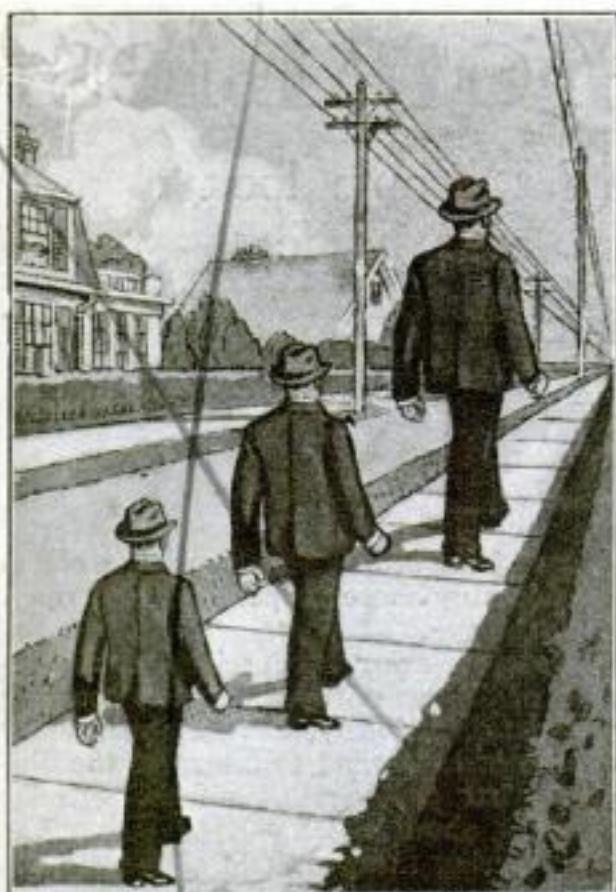


Fig. 2—Does the border of this rectangle look straight or curved? Here again the trick of diagonal lines makes the rectangle appear to bulge at the center and taper at the ends. Yet the outside lines are parallel



could conceal the true perspective of a vessel by the way we used lines, spots, and colors, we wanted the lines, spots, and colors to show up as brightly as possible. The submarine judged the course of a ship by its perspective lines. Wherever possible we distorted these lines; we pinched together or widened the natural lines at the bow or the stern, or made wide marks across them, so as to conceal the true shape of the ship and thus in the end make its speed and course difficult to compute.

**SOMETIMES** we tried to make them look long, sometimes short. The fast vessels we painted to look short and stubby, and we tried to make the slow freighters look as slim and fast as we could. As a result of this sort of camouflage a number of submarines, in the last



#### Which Man Is the Tallest?

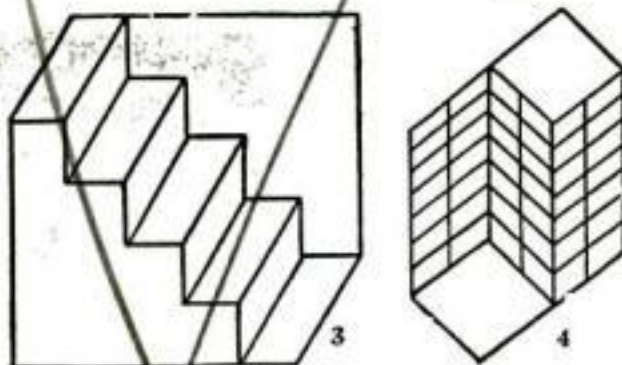
You'll find it hard to believe that these three men all are the same size. Yet if you measure them with a ruler, you'll find that they are. Your eyes are tricked by the fact that everything in the picture has been drawn in perspective except the three human figures.

few months of the war, so miscalculated the speed and direction of vessels they were attacking, that they came up too close to them, and being unable to train their torpedoes fast enough were promptly run down or captured.

Just to see how effective it was, and how your eyes can be deceived, try out on yourself the surprising tests shown on these pages.

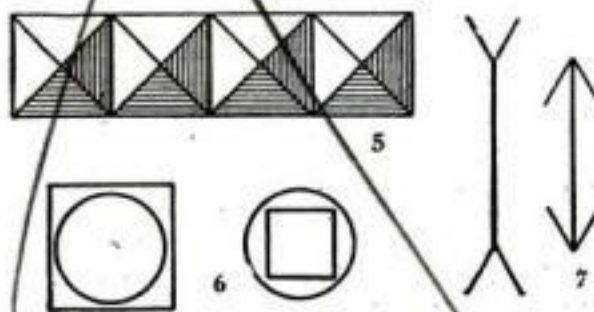
If you have any faith in your eyes, for example, Figs. 3 and 4 probably will remove the last vestige of it. Here are two striking examples of things that seem to change while you watch them.

Do you see the top side of steps in Fig. 3 going up, or the under side of steps going down? Look again. What do you see this time? Maybe you see just a design in black and white. Now, just what do you see in Fig. 4? Is there a solid block with the top toward you on the right, with a kind of wing and an open space or hollow at the left? Or do you see the solid to the left and the hollow space to the right? Or do you see two solids set at an angle to each other? Observe this solid



#### They Change before Your Eyes

Look closely at the steps in Fig. 3 for a moment or two. Suddenly you will see them turn upside down before your eyes. You will find that your eyes play the same amazing trick with the chimney-like object in Fig. 4.



Do you see the pyramids in Fig. 5 pointing toward you or away from you? Watch them a moment. You will see them change while you look. Which circle in Fig. 6 looks larger? They're really the same size, surprising as it may seem. And in Fig. 7 does the perpendicular line at the left look longer than the one on the right? It isn't. They're the same length. Your eyes merely have been tricked by slanting lines, in one case pulling your sight beyond the ends of the line, in the other pulling your sight in toward the center.



#### Legs that Fool You

You'll swear that one of these men is bow-legged, the other knock-kneed, won't you? Now hold the page on a level with your eyes and look along it from the bottom edge. You will see that all four legs are perfectly straight.

carefully. Does it seem to slip over to the other side while you are watching it? It is an odd sensation to see it change right before your eyes, is it not?

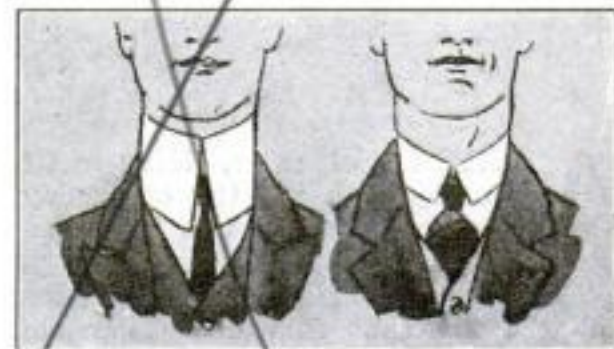
These are examples of what is called "ambiguous perspective," the principles of which we used during the war in paint-

ing ships. These curious coats of various colors were put on, not to render the ship invisible, but to deceive the enemy as to the size and shape and the course it was pursuing.

If you will hold your hand before you silhouetted against a bright area like a very bright sky, you will see, if you move it swiftly to the right, a bright line just behind its back edge, and outside that a dark shadow, a sort of a ghost of the hand itself.

**IT TAKES** a keen eye to see this phenomenon under the most favorable circumstances, but we are told that the light and pursuing shadow are always just behind any swiftly moving object. This is the reason we cannot see a really swift motion. The dark edge following gets confused with the real edge. The camera rarely reveals this, and that is one reason it can show things the eye cannot see. If the fast camera can eliminate this confusion of edges, there seems to be no reason why science may not one day hand us a pair of eyeglasses that will do the same. We have glasses to correct far sight and near sight. Why not glasses for swift sight?

You can be deceived just as easily with color as with line. If you take a deep red



#### Which Neck Looks Longer?

The man with a long neck usually seeks to make it look shorter by wearing a high collar. Actually the high collar makes it look longer. The necks in the picture are the same length.

background, look at it for a while, then place strips of gray paper against it, the strips will appear a ghostly sort of green. On a blue surface your strips will look orange. Easier than that, try looking at a strong electric light for a few minutes, then look at a blank wall. You'll see the light exactly the same shape, but the color will be purple.

**A BOOK** on dress recently warned against wearing too much orange, because it gave blue shadows to the face. Primary colors—red, blue, yellow, green, orange, and purple—have a tendency to make us see their opposites. In other words, wherever you see one of these, its complement will be hanging around and you will catch glimpses of it now and then out of the tail of your eye.

So, you see, your eyes can't be trusted. Things are not what they seem. At first it may appear rather a low trick for your eye to play you; but when you think about it, I believe you will agree with me that it is a fair arrangement. If the eye could not be tricked into making high spaces seem low, and broad ones slim, you would have to go on living with your imperfections. But with an understanding of the law of tricking the eye by subtle placements of lines and colors, it is pos-

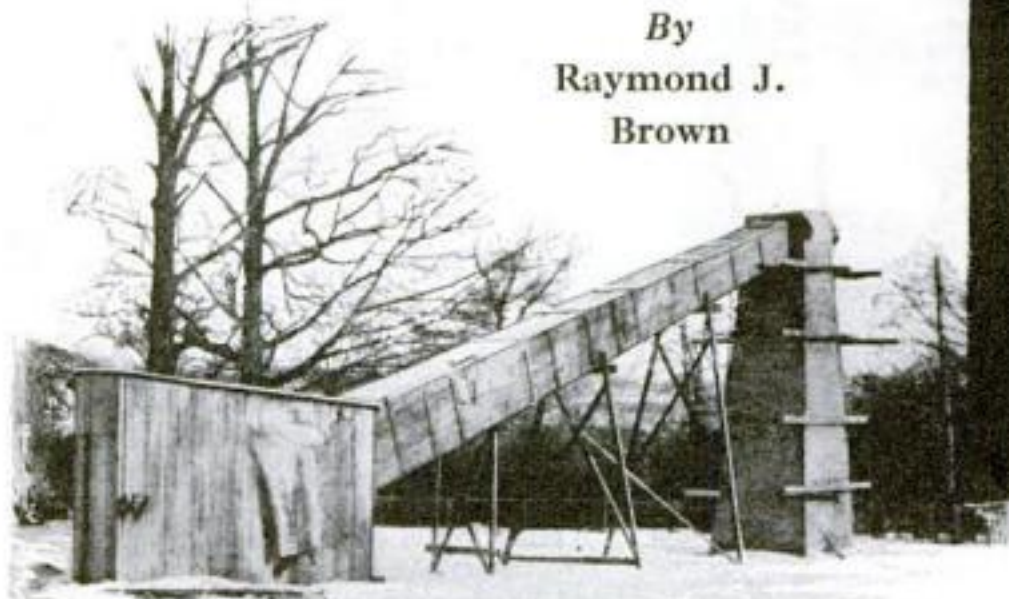
(Continued on page 145)



# Why the Eclipse Was Late

*How Science Is Adding, Little by Little, to Our Knowledge of the Sun*

By  
Raymond J.  
Brown



The Sun in Total Eclipse

A remarkable photograph of the eclipse of the sun January 24, made by the 62-foot camera (at left) of the Swarthmore College expedition at the Yale University observatory. It gives a spectacular view of the corona extending hundreds of thousands of miles into space. In the original photograph the diameter of the moon measured about  $\frac{1}{4}$  inches.

ON LAST January 24 occurred what was in some respects the most remarkable eclipse of the sun in the history of the world.

More people undoubtedly saw that eclipse than saw any previous one, for the reason that the path of the moon's shadow was across territory more thickly populated than any that the shadow ever had traversed. Likewise, in the path of totality stood a larger number of astronomical observatories than ever before were situated in the path of a single eclipse. Because of available conveniences of transportation, many American astronomers whose permanent stations lay outside the path of totality found it relatively easy to move their instruments and establish temporary stations at places from which the phenomenon would be visible in its entirety. Clear skies virtually throughout the path of totality facilitated observation of the eclipse in all its phases both to scientists and laymen.

Due to recent developments in the science of aerial photography, it was the first eclipse in history of which the world was assured of permanent photographic records no matter what the weather; for, if the day had been dull, airplanes could have ascended high above the clouds and the photographers snapped the hidden sun in the mistless light of the upper atmospheric strata.

ALSO, at least one entirely new and unique investigation was made when science seized the opportunity offered by the eclipse to study the mysterious effect of darkness on radio transmission and reception.

In short, Nature arranged and carried out the details of the eclipse like a master stage director, and supplied at one time a gorgeous spectacle for the layman and

the means of making the complex observations through which astronomers have learned all that they know about the sun. The program was a little late in starting, but that was expected, because eclipses, for reasons that will be explained presently, never occur exactly on time; they always arrive a little later or a little earlier than the time predicted.

And so it would seem that with conditions so favorable this eclipse ought to have yielded a wealth of new scientific knowledge regarding the sun. Possibly it will. At the present writing, however, approximately a month after the eclipse, science has but little to report, the reason being that knowledge of the sun is wrung with almost incredible slowness and diffi-

culty from the observations and photographs made at time of eclipse. In fact, the long and complicated calculations and measurements incidental to compiling the mass of data recently obtained scarcely have been begun.

Professor John A. Miller, director of the Sproul Observatory at Swarthmore College, Swarthmore, Pa., leader of an expedition that observed the eclipse from the grounds of the observatory at Yale University, New Haven, Conn., explained to the writer a few days ago why new knowledge of the sun is so rarely obtained.

"WHAT we know of the sun," he said, "is the cumulative results of thousands upon thousands of observations made during hundreds of eclipses and at other times. No one eclipse can be expected to yield results of a startling kind. As an example of the slow way in which things move with regard to the sun, take helium. This element was discovered in the corona of the sun during an eclipse in 1868. Almost 30 years passed before it was learned that helium was a terrestrial element also; and it is only now, a quarter of a century or so later, that man is finding a useful application of helium in the inflation of airships.

"There was no discovery made at the recent eclipse comparable in importance with the discovery of helium. Of that we are certain. Just what information of a really important nature the eclipse will yield we shall not know for months probably; years, perhaps; at least until we have completed the measurement of our photographic data and our calculations.

"Our photographs already have disclosed one fact of interest to the astronomer—namely, that although it is only  $2\frac{1}{2}$  years after the minimum sunspot period, the shape of the corona shows that

(Continued on page 141)



Photographed from the Air

An airplane picture of totality made from a height of 18,000 feet by the Fairchild Aerial Camera Corporation. Note that the moon appears egg-shaped. This distortion is due to the fact that the airplane was moving rapidly when the photograph was made. If, however, the day had been cloudy, preventing ground cameras from snapping the spectacle, airplane pictures such as this would have been invaluable for astronomical study.





### Why Colds Spread—Beware of Sneezes and Coughs

If you are in the path of a lusty sneeze such as this you are more likely to catch cold than if you are exposed to severe weather or get your feet wet. For the common cold is extremely

contagious. The corpulent, overfed man in the rear, who apparently is the least concerned, is the one who probably is more susceptible to contagion than the thinner passengers

**W**HEN you have a cold—and most of us have one or more each year—do you blame the weather? Most of us do. Miserable and wretched, we speak harshly about the weather, stay indoors, and keep our feet dry.

Now wet feet are not to be recommended at any time, but reports of a recent survey undertaken by the United States Public Health Service indicate that we can no longer be sure of our ground when we blame the weather for a cold in the head or other nose and throat disorders.

This survey is the first effort of its kind to determine when, how often, and why, we suffer from colds, coughs, and allied ailments. The results seem to have upset a number of popular beliefs. Chief among these surprises is an indication that meteorological conditions, at least during the year studied, have little bearing on the prevalence of colds, bronchitis, influenza, sore throat, hay fever, and pneumonia.

This lack of relationship between colds and the weather in the United States is demonstrated in the startling similarity between cold-occurrence in the rigorous North and that in the warmer South and Pacific Coast. In general, New Orleans and San Francisco suffer with Chicago and Boston—and at very nearly the same time of the year.

**T**HIS conclusion, reached by the Public Health Service, is based on reports of health conditions among representative groups of people in Massachusetts, Ohio, Illinois, Maryland, the District of Columbia, Louisiana, Montana, Utah, Arizona, and California, covering a period of a little more than a year.

That colds have their seasonal out-

### What Science Has Found Out about Colds

The common cold is extremely contagious.

It does not come from bad weather or wet feet, but from germs that attack those whose physical condition makes them susceptible.

Each of us, on an average, suffers from 3.7 colds a year.

Colds make no distinction between youth and age. But indoor workers and city dwellers seem more susceptible to them than those who have outdoor occupations or who live in the country.

October is the worst time of the year for colds. Another bad month is January. June is the month in which you are least likely to catch cold.

breaks is borne out by a study of these reports. The indications are, however, that colds are not most frequent in the heart of winter, but that in most sections under survey the highest prevalence of trouble comes in October. For all the centers embraced in the study the October "epidemic" was shown to be perhaps 20 per cent greater than the next highest ratio, reached in January.

During the latter half of October respiratory troubles appear to sweep from coast to coast, and from New England to the Gulf. During November and December the

# COLDS:

By Malcolm MacDonald

ratio declines, until the last days of the year show the average-line within hailing distance of the lowest point between October 1 and June 30. This comes at a season when Massachusetts is in the midst of a New England winter and New Orleans, La., Tucson, Ariz., and San Francisco, Calif., are living outdoors in the sunshine.

**T**HUS do actual health records contradict our common beliefs about colds.

The new year starts with an outbreak of colds that begins late in December, finds its peak in the early days of January, and sharply recedes before the middle of the month. From this time forward to the end of June there is a steady decline in respiratory ailments.

The groups on which the figures of the Health Service are based may be regarded as being fairly representative of the entire population. For the greater portion the survey deals with college students, among whom more than 13,000 individuals were examined. College students are likely to be of the same general age. To offset this selective grouping, and to afford more intimate study of conditions in family life, the research also has embraced groups of families throughout the United States, with reports covering entire households, including



Two Extremes

Indoor workers are more likely to catch cold than those who, like the telephone lineman, work in the open air. The lineman, however, if subjected to the continued weakening effects of extreme exposure, becomes more susceptible to the much graver menace of pneumonia.



## How you get them, how to avoid them, and how to treat them. Vital new discoveries about this most common of man's ailments

servants. These latter groups included the families of medical officers of the army and navy, the medical and scientific personnel of the Public Health Service, and the faculty members of the selected colleges.

**P**RELIMINARY compilations of the investigation, which, by the way, is still in progress, show that in a fairly representative group there were few individuals who escaped colds during a period of 5½ months. The figures also disclose that only 10 per cent escaped colds entirely. In the period studied the individual cold average was 1.9. Should the same rate obtain throughout the year in the country, it means that if you have your share you will have 3.7 colds each year.

In the past there has been no basis for study of the prevalence of such minor ailments as the common cold. Such ailments are not included in the lists of diseases that must be reported to the local authorities. But by continued investigation the Public Health Service hopes to obtain much additional information as to the prevalence of respiratory ailments and their causes.

While the data so far gathered shows clearly that all sections suffer from numbers of common colds at about the same time of year, the outbreaks in New Orleans are entirely independent of those in Chicago, Boston, and San Francisco. Apparently there is no exchange of infection in these outbreaks. The attacks come relatively simultaneously.

Another phase of identity is found in the duration of illness. From north to south and from east to west the average length of disability for all respiratory disorders is slightly less than 6½ days.

Medical experts on the subject tell me that the common cold is no respecter of years, but comes to old and young alike. The same may be said concerning sex. Apparently boys and girls, men and women are equally susceptible.

When it comes to a comparison between town and

country, there seems to be an advantage in favor of the person living away from the congested centers. The reasons are obvious. City houses are apt to be overheated. The evidence brought forward by medical observers tends to prove that where an indoor temperature of more than 70 degrees is maintained during cold weather, there is an increase in respiratory disorders.

The reason for this is that in overheated rooms the relative humidity of the air, on which our health and comfort largely de-



### Make Your Own Hygrometer

An efficient hygrometer, or wet and dry thermometer, with which you can determine the relative humidity of your rooms, can be made easily from two ordinary household thermometers, as shown in the illustration. Simply mount the thermometers on the same board and keep the bulb of one of them moist by means of a wick tied around the bulb and dipped into a small medicine vial filled with water. The table below will enable you to determine the humidity from the difference in the readings of the two thermometers. For healthful conditions the humidity should be above 50 per cent

### How to Find Relative Humidity

**S**UPPOSE the dry bulb reads 70 degrees and the wet bulb 60. The difference will be 10 degrees. Now run down the column that has the

figure 10 at the top until you come to the horizontal column corresponding to a dry-bulb reading of 70. At this point the number is 56, the relative humidity.

#### Difference between dry and wet bulb thermometers

Dry Bulb	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
50	93	87	81	74	68	62	56	50	44	39	33	28	22	17	12
52	94	88	81	75	69	63	58	52	46	41	36	30	25	20	15
54	94	88	82	76	70	65	59	54	48	43	38	33	28	23	18
56	94	88	82	77	71	66	61	55	50	45	40	35	31	26	21
58	94	89	83	77	72	67	62	57	52	47	42	38	33	28	24
60	94	89	84	78	73	68	63	58	53	49	44	40	35	31	27
62	94	89	84	79	74	69	64	60	55	50	46	41	37	33	29
64	95	90	85	79	75	70	66	61	56	52	48	43	39	35	31
66	95	90	85	80	76	71	66	62	58	53	49	45	41	37	33
68	95	90	85	81	76	72	67	63	59	55	51	47	43	39	35
70	95	90	86	81	77	72	68	64	60	56	52	48	44	40	37
72	95	91	86	82	78	73	69	65	61	57	53	49	46	42	39
74	95	91	86	82	78	74	70	66	62	58	54	51	47	44	40
76	96	91	87	83	78	74	70	67	63	59	55	52	48	45	42
78	96	91	87	83	79	75	71	67	64	60	57	53	50	46	43
80	96	91	87	83	79	76	72	68	64	61	57	54	51	47	44



### Four Ways to Avoid Catching Cold

pend, is likely to be unusually low. "Relative humidity" means the amount of moisture in the air in comparison to the amount that the air could possibly hold. If the relative humidity of the room is 50 per cent, we understand by that that the air in the room has just half as much moisture in it as it could possibly hold at that particular temperature. Its ability to hold moisture increases as the temperature is increased.

**I**N THE wintertime the temperature of the outside air is very low, and consequently the amount of moisture in it is very low. When this dry air from the outside comes into the house, it is warmed. This makes it capable of holding much more moisture than is already in it. Consequently the relative humidity of the air in the home is very low.

In many homes the air in the wintertime is drier than the air over a desert.

The results are that the perspiration from our bodies evaporates very rapidly, making us cold, although the room is quite warm as far as the temperature is concerned. If the relative humidity of the home is between 50 and 60 per cent, a temperature of 68 degrees will be found very comfortable; while with dry air a temperature of from 70 to 75 is necessary for comfort.

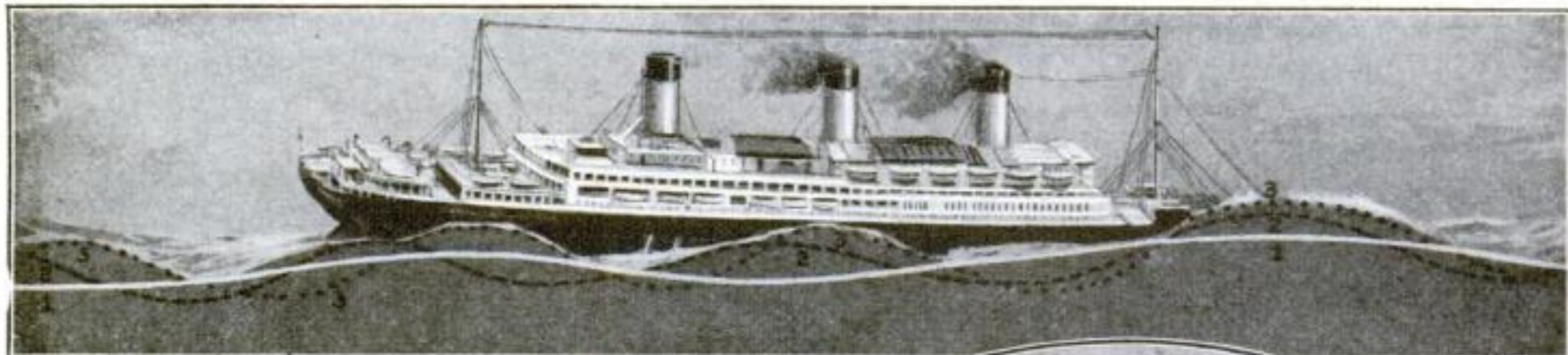
This hot dry air is very irritating to the nerves and injurious to the eyes. It makes

(Continued on page 146)

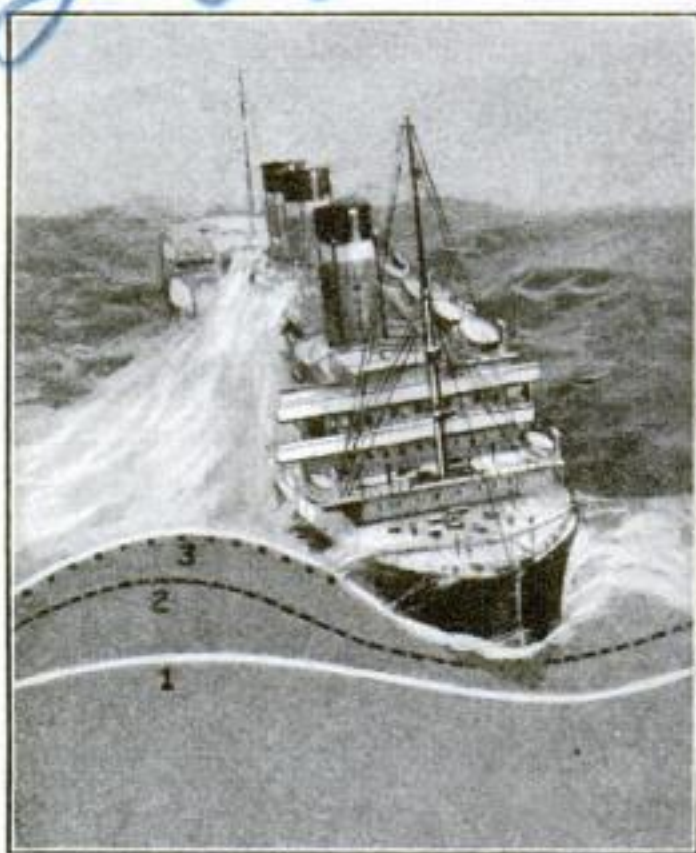


# What Huge Seas Do to Ocean Liners

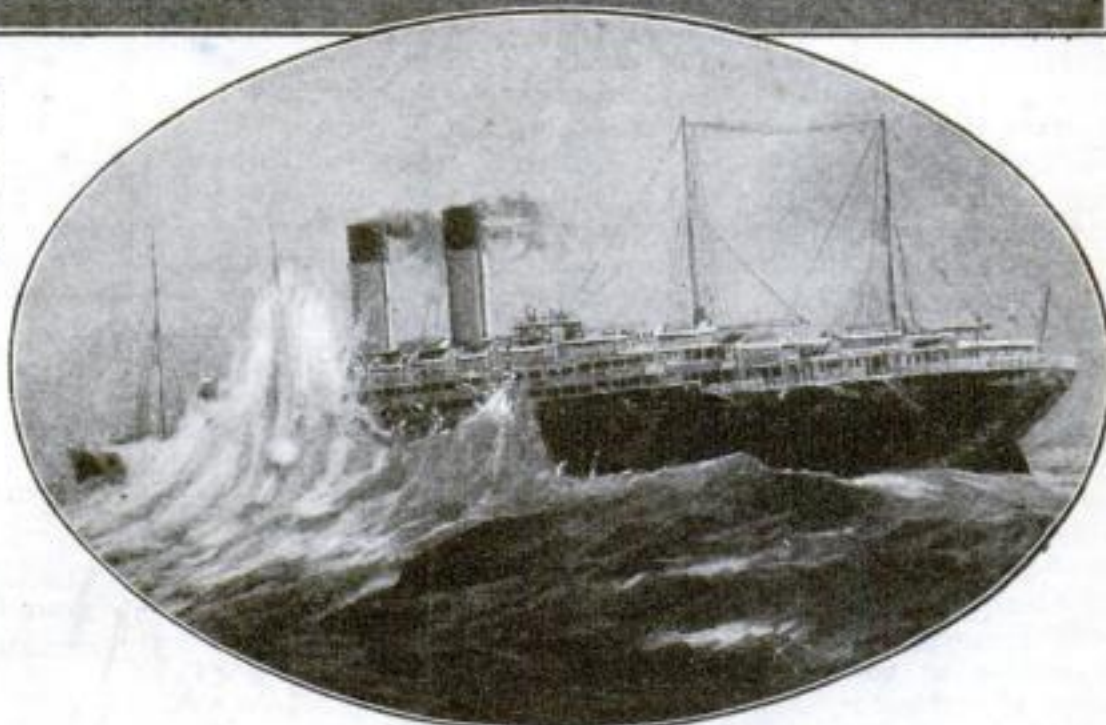
## An Explanation of the Origin of Recent Giant Waves



**What Causes a Mountainous Wave**—Lines 1, 2, and 3 represent three separate series of waves of different lengths. Occasionally the crests and hollows of the series coincide, piling up a huge wave, as shown at the right. If a liner's nose happens to be down when she encounters one of these exceptionally large waves, she takes the all-enveloping sea right over her bows.

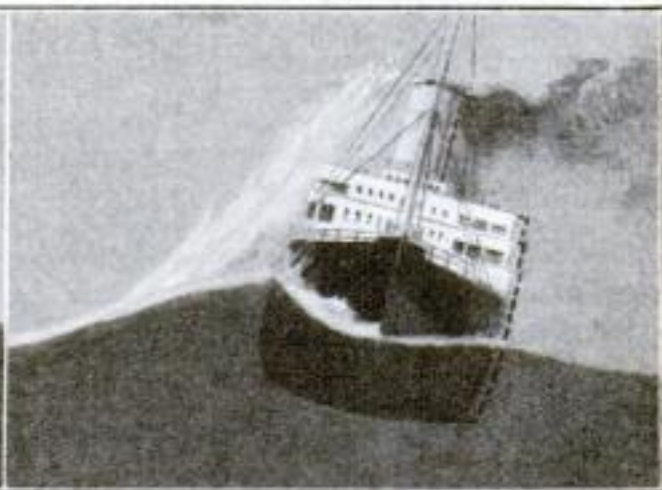


**A Dangerous Beam Sea**—This picture shows what happens when a great liner, with nose down, rolls inward toward one of the huge waves caused by reason of three waves coinciding.

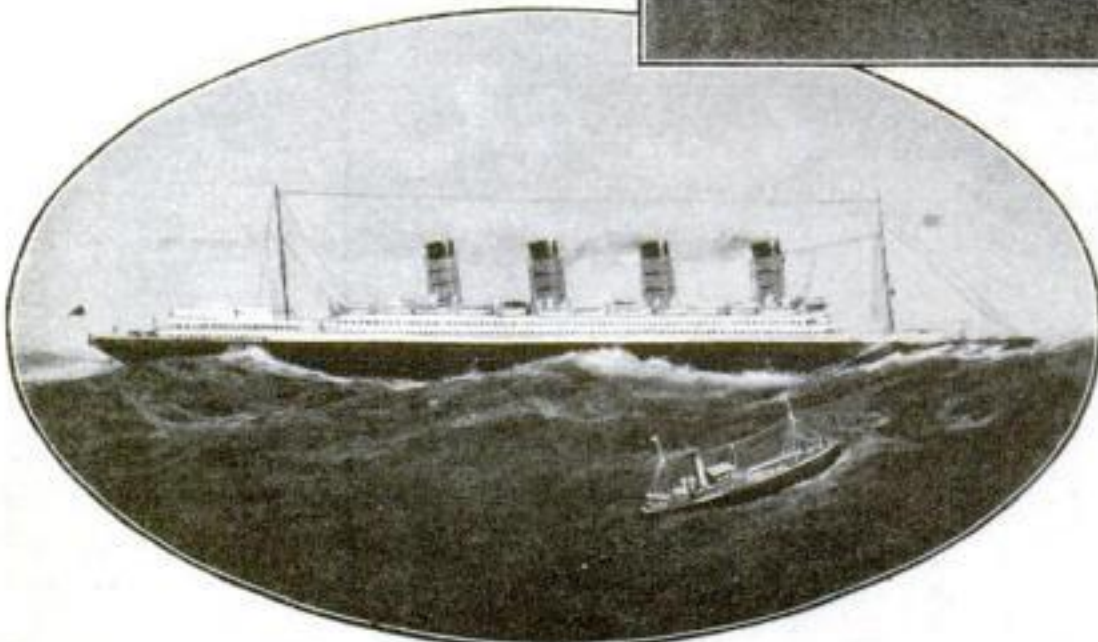


**How Most of the Damage Is Done**—When a large liner rolls with maximum velocity into the trough of one of the great waves,

the full force of beam seas crashes against her sides. Because of her weight and size, the ship has little "give" before such a battering.



**Why the Big Ship Gets the Worst of It**—A heavy wave strikes a big liner with greater force than it does a smaller ship, because the liner offers greater resistance. The smaller ship (at left) can "give" more to the sea, as indicated by the dotted lines.



**The Pitch of Ships**—A long, heavy liner, pitching regularly, does not rise quickly to a heavy wave, with the result that a deluge

of water occasionally pours over the bows. But a trawler, smallest of sea-going ships, quickly rises and falls over the crest of the wave

**WHEN** gales of cyclonic fury struck Atlantic shipping during the last two months, it was noticeable that some of the largest liners were the worst sufferers. Fittings were damaged, staterooms flooded, and passengers thrown about and injured. Even on the *Leviathan*, the world's largest ship, passengers were slightly hurt.

The average height of waves during an Atlantic gale, mariners say, is about 40 feet. How is it, then, that waves can rise to such a height as to damage the decks and fittings of liners often from 80 to 90 feet above the normal water line? By the aid of picture and line the artist, G. H. Davis, has given a graphic explanation.



# The Inventors Who Speed YOUR MAIL

*Marvelous Time-Saving Machines  
Devised by U. S. Postal Employees*

By Norman C. McCloud



**Twin Letter-Boxes**

One of the boxes is for local letters, the other for domestic and foreign mail—a simple new idea that saves time in sorting at the post office

I WAS in the office of a New York business man on a Monday afternoon a few weeks ago while he was signing his day's correspondence.

"Here's a letter that must get to San Francisco by Saturday," he said. "I wonder if I ought to send it by air mail. No," he decided, "it will get there Friday night and be delivered on Saturday by ordinary mail."

And without another thought to the matter, he went on signing the remaining letters.

Most of us are like that man. We take the mails for granted. When we address a letter to a place two days' railway journey away, we mail it in entire confidence that it will be in the hands of the addressee at the end of the second day.

Few, I am sure, realize that the transfer of a piece of mail matter from one part of the United States to another is a process quite as complicated and quite as wonderful as is the process by which a song sung in a broadcasting station on the Atlantic Coast is hurled through the ether to be reproduced by the radio receiver owned by a man in Colorado. Few, too, I am sure, suspect that this seemingly simple process of mail transfer is accomplished largely through the agency of a vast number of ingenious mechanical devices that have been developed for that sole purpose. And it is only by the invention of these time-saving and labor-saving devices that the Post Office Department has been able to keep abreast of the tremendous pressure of modern business and industry. It permits no operation to be performed by human hands that can be performed more accurately, efficiently, and speedily by machinery.

THE department maintains an Engineering Division that is charged with the responsibility of speeding the mails by means

of improved practices and newly invented equipment. Congress encourages inventive genius within the postal service with a fund to provide cash rewards for employees who develop devices adopted by the department. As a result, some of the most valuable inventions that speed your letter to its destination have been developed by postal shop workers.

Take the "facing table," for an example.

Every hour collectors in the crowded business sections of our large cities dump into post offices thousands upon thousands of letters. These are addressed to every corner of the earth; they are in many sizes; in bundles and separate. The envelopes face in every possible direction. Some are upside down. Others are crosswise and askew. And this chaotic mass must be put in order. Each letter must be started on the way to its destination without chance of



**Unscrambling the Mail**

The "facing table" is one of the most ingenious of the new time-saving postal inventions. Letters by the thousands are dumped on a circular platform where clerks turn them right side up, then insert them in a slot. They emerge neatly packed in stacks according to size, each letter face up with the stamp in the right-hand corner, all ready for the cancelling machine

error. To do this by hand would require an army of clerks, and even then might result in utter confusion.

But the facing table has solved the problem. This device consists of two round platforms, the upper fixed, the lower revolving. The clerks work on the upper platform, which resembles a large dining-room table with a slot at the edge.



**A Mechanical Sorter**

As letters are fed mechanically into this remarkable machine, the operator simply notes the address of each and presses a corresponding key on a keyboard. The machine then automatically carries the letters to their proper pigeonholes



On this surface are dumped the letters. The clerks shuffle them about, turning them right side up, and drop them into the slot. The letters fall to the revolving platform, and are carried along to outlets at the far side of the table—long envelopes going into one channel, ordinary correspondence-size envelopes into another. They emerge neatly packed in stacks according to size, each letter face up and with the stamp in the upper right-hand corner, ready for the canceling machine.

This facing table supplies an outstanding example of the spirit of coöperation

directed to every state in the Union and every country in the civilized world.

The established method of distributing outgoing mail has been by hand. Thus a clerk in the New York post office, for example, stands before a case containing about 60 pigeonholes, each marked with the name of some important city or geographical area, and tosses each letter into its proper niche.

For years the postal authorities sought a better and more efficient way. Many machines invented for the purpose failed to solve the problem, until recently an Ohio manufacturing concern produced a device that literally can perform every operation of distributing mail except reading the addresses.

I saw this machine—there is only one in use at present—in operation recently at the Washington post office. Letters are fed into the machine mechanically and pass in a steady stream before an operator seated at a keyboard resembling that of a typewriter machine, except that the keys represent geographical areas instead of

place. When the letter reaches the pigeonhole for which it is intended, it is discharged into it. The pressing of the key sets a trigger on the container that is released only by the mechanism connected with the proper pigeonhole. There are 120 of the latter, twice as many as usually are contained in the cases used for hand distribution. This permits finer distinction in sorting and makes unnecessary a second sorting.

THESE inventions, of course, touch only one phase of the important operation of keeping the mails moving—handling incoming mail matter. Transporting the sorted mail to its destination is the next step. Here, too, the Post Office Department has made generous use of the gifts of science and the products of inventive minds, both in speeding the mail and safeguarding it in transit.

And speaking of safeguards, the Engineering Division has called on science to aid it in supplying protection against bandits. Recently there was put into service a bandit-proof railway mail car, a veritable fortress on wheels, equipped with ingenious devices to protect it against attack. Its walls, roof, and floor are armored like the sides of a battleship, entirely bullet-proof. It is equipped

with portholes through which shotguns may be poked to repel an assault. Around the barrel of each gun is a metal ball, which, when the weapon is thrust through the porthole, closes the latter tight, and permits the gun to be swung through a wide angle.

In the portholes also may be placed magnesium candles, which will light the country for half a mile around and expose robbers to the bullets of marksmen within the car. Should a robber seek to escape the bright glare by diving beneath the car, he is subject to a rain of bullets from shotguns that project through the floor.

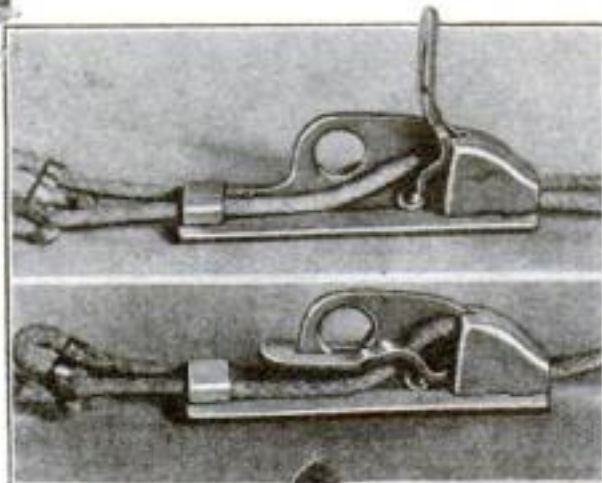


**Cord Cutter**

J. D. Miller of the mail-equipment shops, operating the machine he invented for cutting 20 lengths of cord in one movement of a lever

#### A Lock that Won't Slip

The problem of making a mailbag-cord lock that wouldn't slip was solved by Thornton L. Richardson with the lever attachment shown below. This clamps the cord securely from above



**Cutter-Stamp**

A combination cord cutter and stamp. The blade is on the side

and loyalty that pervades the technical arm of the postal service. The necessity for such a device had been recognized. Employees of the Mail Equipment Shops attacked the problem and speedily produced the table.

Without this table the canceling machine, which in large post offices has superseded the old-time practice of canceling stamps by hand, would be entirely useless. A foreman in the Washington post office demonstrated this to me recently when he placed an armful of unsorted and unfaced dummy letters in the canceling machine. The envelopes emerged with the cancellation marks virtually every place on the letters except where they belonged.

THIS machine handles the normal run of letters—envelopes of various sizes and shapes—at a rate of 10 a second. Gas and telephone bills, or other consignments of mail matter of uniform size and shape, can be cancelled in this machine at the amazing speed of a thousand a minute.

However, these two machines do not solve the entire problem of getting the mail out on time. There still remains the highly difficult task of sorting the letters according to the destinations to which they are addressed. Virtually every collection in a big city brings in letters

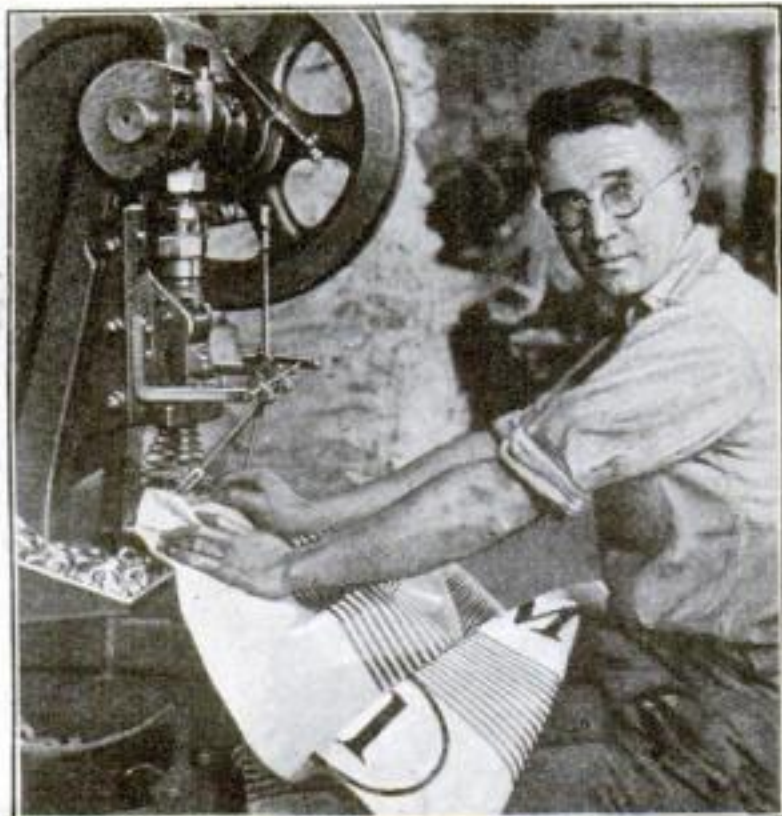
the letters of the alphabet.

As the operator notes the address of a letter, he presses the key that corresponds. The letter moves along in a container, and is picked up by one of a number of metal carriers on an endless chain. This conveyor carries the container over a series of pigeonholes, each a receptacle for mail for a particular



**Twine Holder**

An ingenious postal worker saved the government considerable money by perfecting this holder that prevents loss of twine used in tying bundles of mail



**Simple Spring Device Saves Fingers**

Before A. E. Wilde, a postal worker, invented this safety attachment for punch presses used in manufacturing mailbags, 31 employees had lost fingers in the presses. His device—a spiral spring—has practically eliminated such accidents



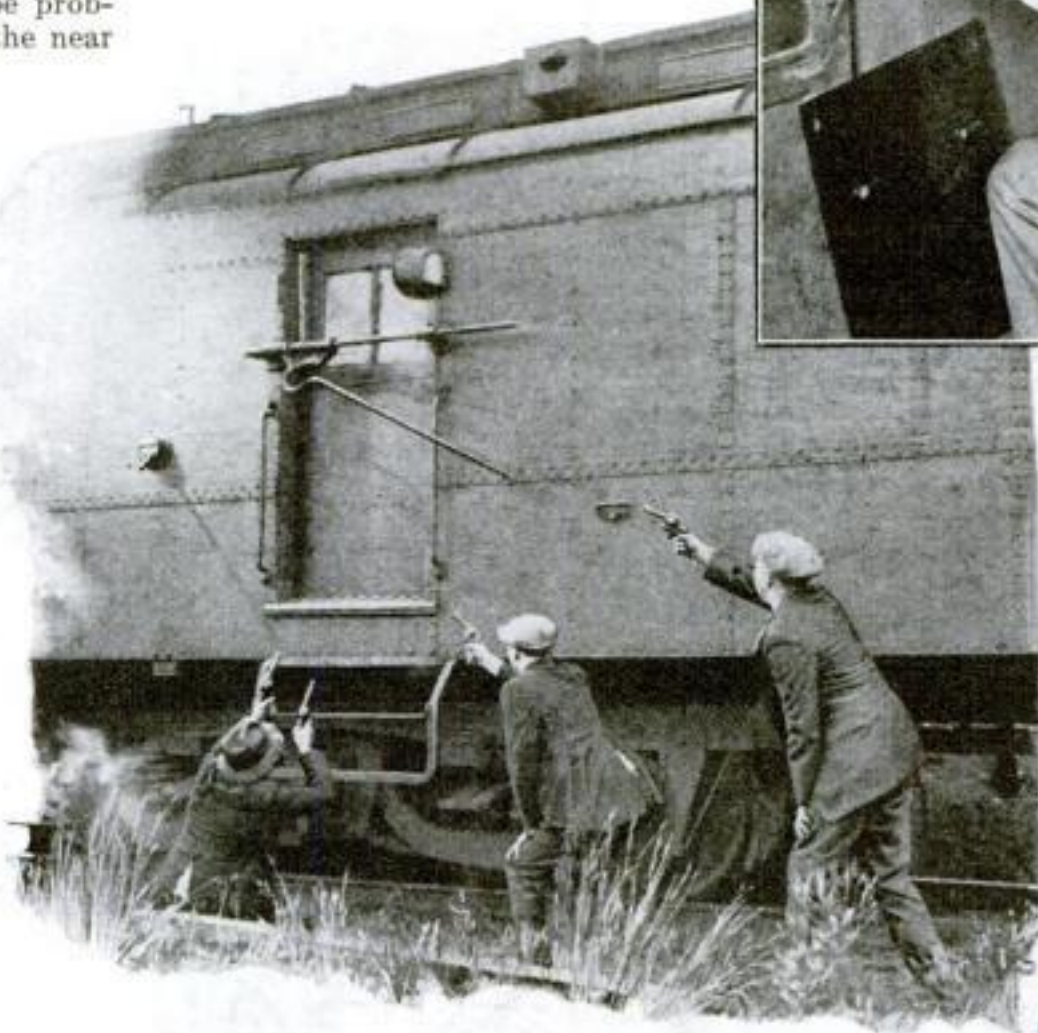


### A Terror to Bandits

Surrounding the barrel of the gun used in the new armored mailcar is a metal ball. This closes the porthole tightly when the gun barrel is thrust through

Beneath the car are metal cones that scatter bullets in all directions. Numbers of cars of this type probably will be constructed in the near future.

Minor inventions issue from the Mail Equipment Shops almost daily. One of the most striking of these devices recently developed is a non-crushable mailbag. The bag, light and wieldy, does not owe its durability to transverse bracing, as might be suspected. The secret lies in reinforcing it with a quarter-inch of "plymetal," a newly invented material that absorbs all weight and shock, distributing them through the length and breadth of the bag.



### Repelling an Attack

In the rôle of robbers, a gang of postal clerks recently staged a realistic hold-up to test the efficiency of the new bandit-proof railway mailcar. The photograph at the left shows them surrounding the car, while a riot gun barks from a porthole in its armor. Within the car a mail clerk, shielded by bullet-proof steel, thrusts the muzzle of his gun through a porthole and sweeps the approaches. In the portholes also may be placed magnesium candles to light the surroundings and expose the bandits to the bullets of the marksmen inside of the car

**T**O PROVE to me that the bag will supply protection to fragile articles in transit S. W. Farnsworth, Chief of the Engineering Division, placed several empty pasteboard shoe boxes in one, and then had a 200-pound postal employee stand on it. The boxes came out just as they had gone in. Because the bags are flat and compact, many of them may be packed on one car, thus permitting packages that ordinarily would have to wait for the next train to go forward.

The problem of devising an effective fastening device for mailbags was one of the most troublesome that the technical men of the Post Office Department ever faced. For years, bags had been fastened by a cord lock that slipped at annoying moments. Dozens of substitutes had been tried, only to be discarded.

A few months ago, however, Thornton L. Richardson of the Mail Equipment Shops in Washington received a cash award for devising a method for bending tumbler springs for mailbag locks. The government's recognition of this invention inspired Richardson

### He Can't Crush It

To test the protective quality of a newly developed non-crushable mailbag, a 200-pound postal employee stood on the top of one of the bags containing just two empty shoe boxes. The boxes remained undented by the weight



to tackle the fastener problem. As the result, he invented a lever attachment that clamps the cord lock from above, engaging the cord lengthwise and holding it secure under any conditions of use. His device is now standard equipment, and he has received his second cash award of a few months, this time for doing a thing that "couldn't be done."

J. D. Miller, of the Mail Equipment Shops, recently evolved a simple machine that in one motion cuts 20 lengths of the cord required for fastening mailbags. Another ingenious employee saved the Post Office Department a large sum of money by perfecting a holder that keeps in place and prevents loss of the twine used by carriers and clerks in tying bundles of mail. And a recently devised combination canceling stamp and cord cutter, to be used by post office clerks in opening bundles, is a third clerk's contribution to the movement of the mails.

Sometimes there is an element of humor in these inventions by postal workers as, for example, when Tony Lombardi devised a "jig" whereby he doubled the amount of work he

could do in operating a machine for reaming keyholes in mailbag locks. Tony kept his invention to himself, fearing he might be discharged for daring to make an unwarranted improvement on a government machine. It was not until his superiors noticed how much more work he was turning out than any other man in the shop that his device came to light. Then, to Tony's utter astonishment, he received a cash award, a citation from the Postmaster-General, and his "jig" was made standard equipment.

**O**NLY a short time ago, another cash award was made to A. E. Wilde of the Mail Equipment Shops, for a safety attachment for the punch presses used in the manufacture of mailbags. Before this attachment—a spiral spring that warns the operator of the drop of the punch—was installed, 31 employees had lost their fingers in the presses. Since the adoption of the device there have been few accidents in that department.

Airplanes, motor-trucks, and even caterpillar tractors, are carrying the mails today to people in remote sections. For every letter and every package that is deposited in a mailbox must go forward to its destination without delay. That is the creed of the Post Office Department, and storms, ice, snow, and countless other agencies seem to conspire to prevent its being carried out. Against these opposing forces the postal authorities have marshaled the powers of modern science.



# New Milestones Passed

## How Problems of Flight Are Solved

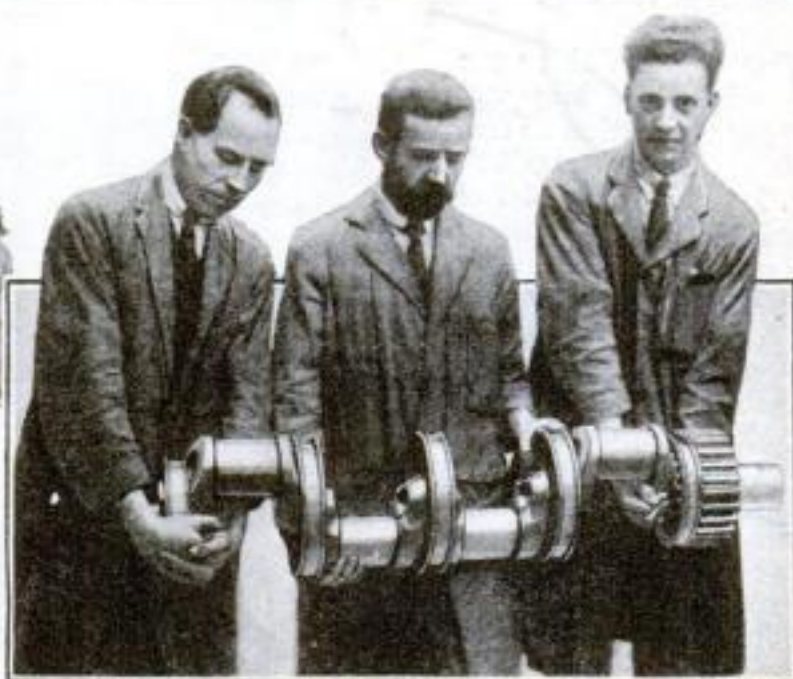
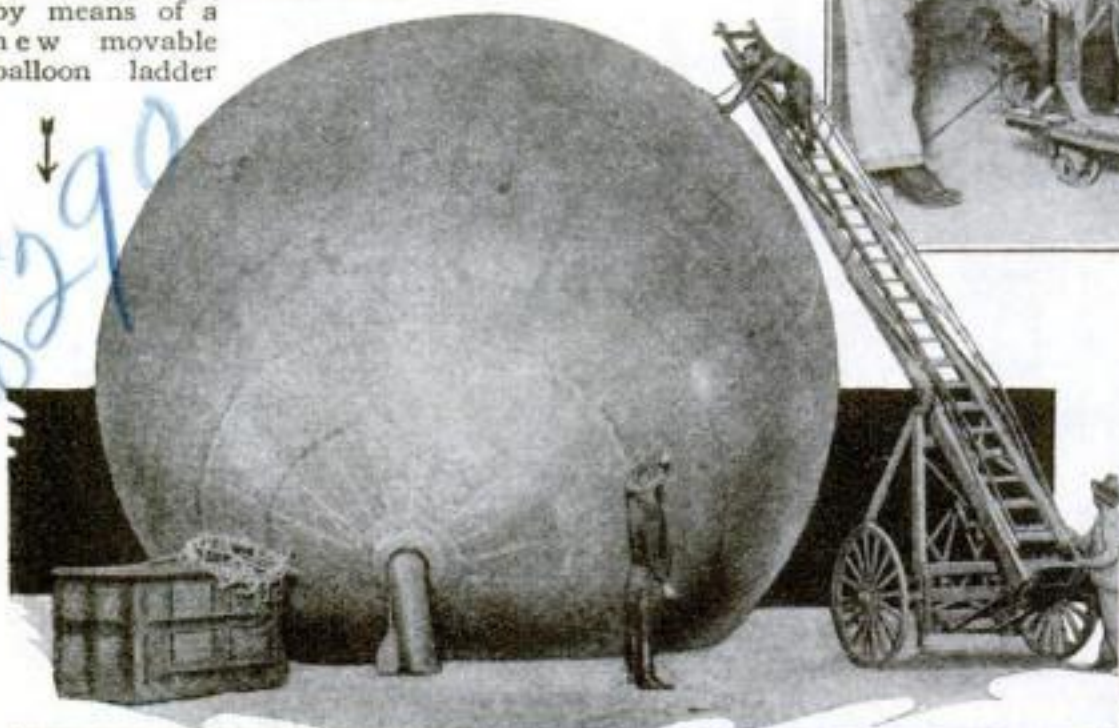
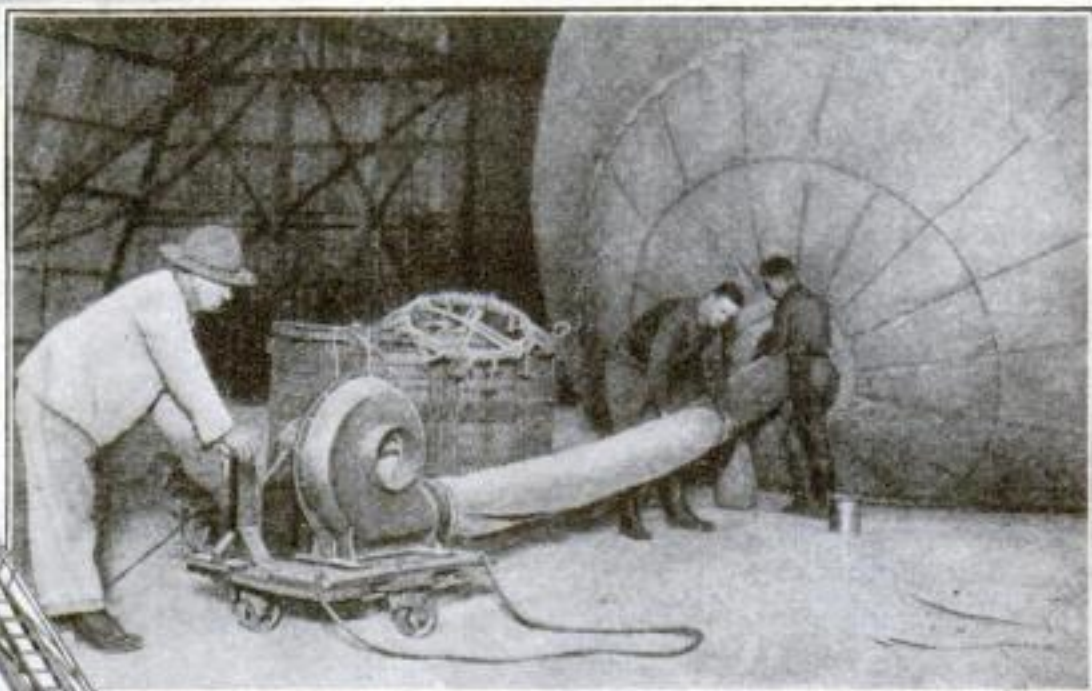
### Aero-Skiing—A New Sport

Skimming the ice at 90 miles an hour in a wingless airplane mounted on skis is a thrilling new sport devised by an ingenious aviator of Quebec Province, Can.



### Preparing Balloons for Flight

Ross Field, Arcadia, Calif., recently has become the scene of important developments in balloon navigation by army experts. At the right a balloon capable of soaring seven miles above the earth is being inflated preparatory to flight. Below, Lieut. C. P. Kane, commandant, is shown inspecting a balloon by means of a new movable balloon ladder.



### Huge Crankshaft

Three men are needed to lift the crankshaft of the world's largest aircraft engine, the Napier "Cub," completed recently at Acton, England. This motor weighs more than a ton and develops 1200 horsepower. A locomotive of the same power would weigh 75 tons.



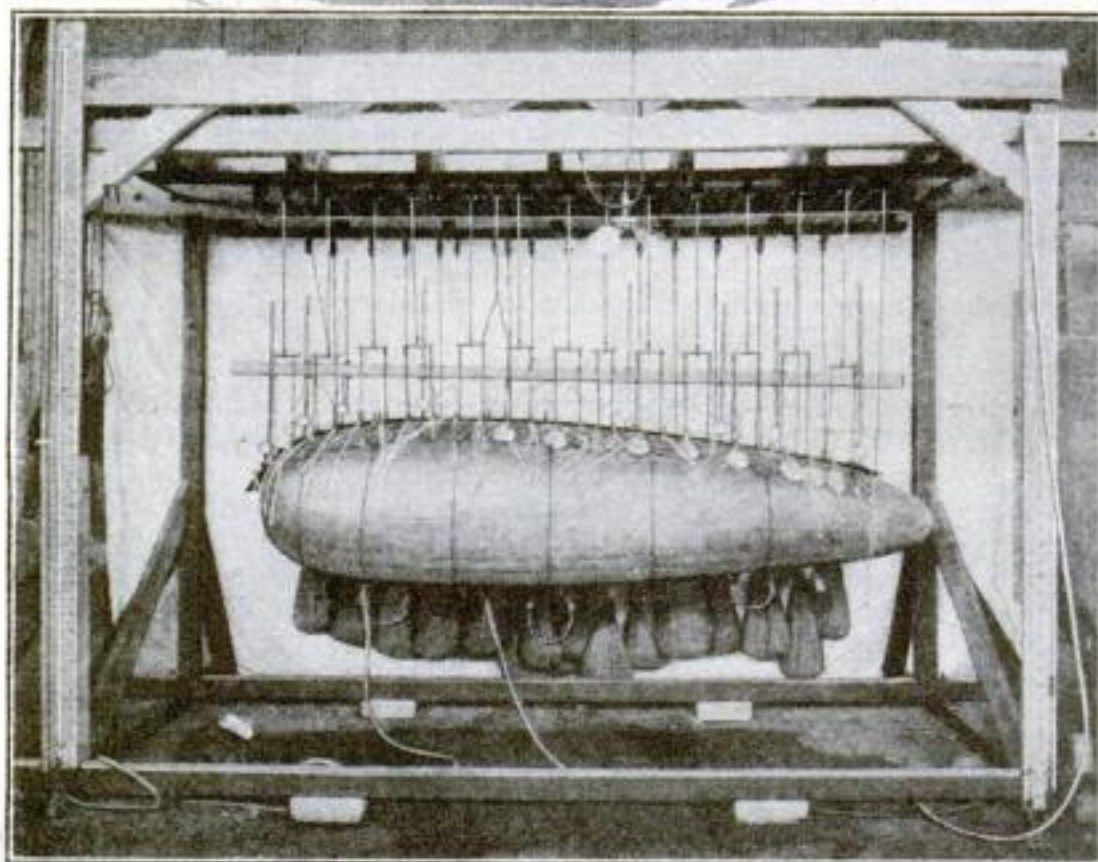
### New Parachute

A new type of airplane parachute, worn like a knapsack, is under test in England. The release cord is attached to the airplane, causing the parachute to open automatically when the wearer must jump.

### Weighted Models Used in Airship Tests

A novel test for lighter-than-air craft was developed recently by army engineers at McCook Field, Dayton, Ohio. A model of the ship is suspended from a rack and filled with water. Then weights are hung

below. Aeronautical experts are able to determine from the behavior of the model exactly how the actual machine will react in the air to the various strains and stresses to which a flight would submit it

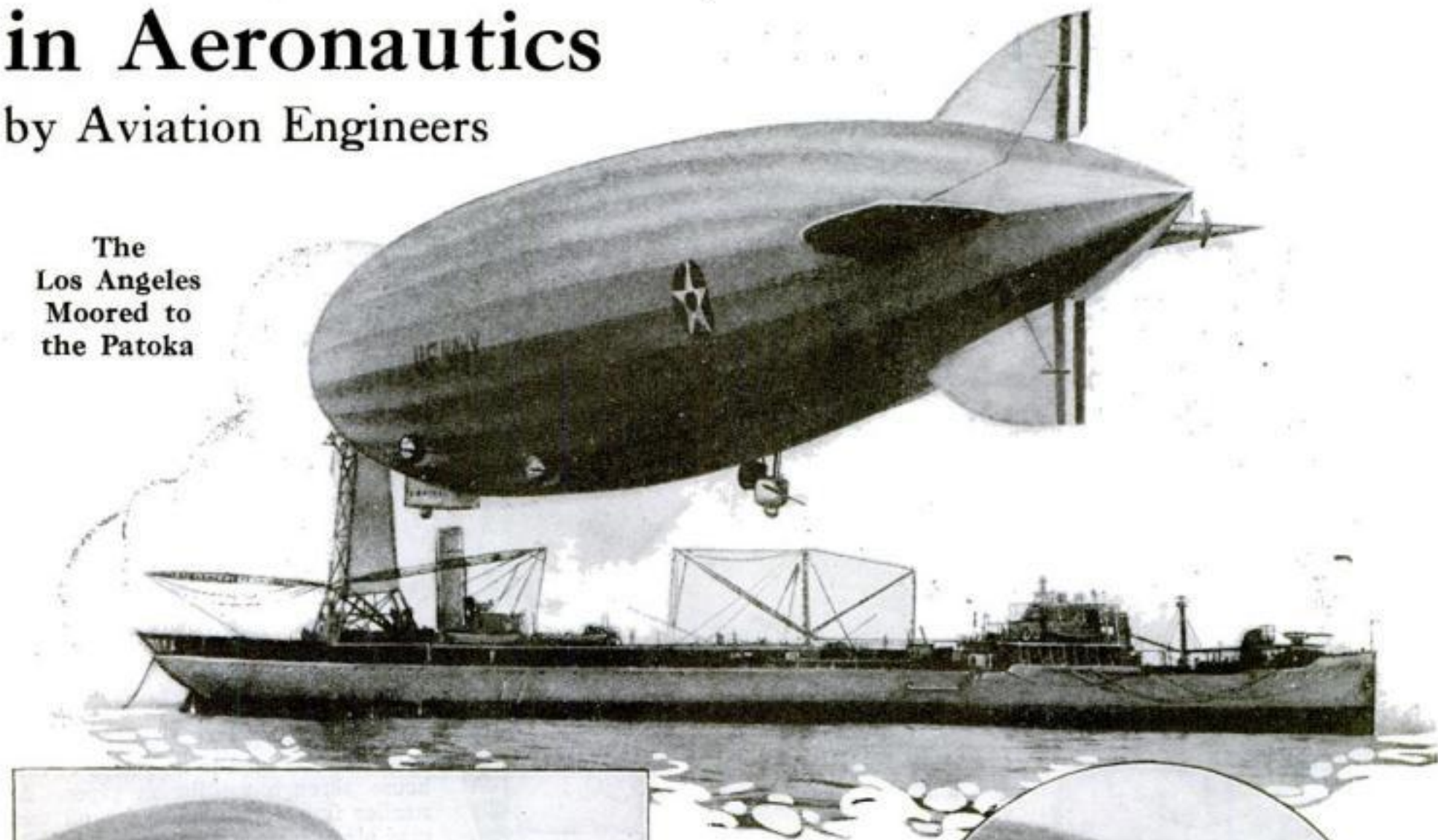




# in Aeronautics

by Aviation Engineers

The  
Los Angeles  
Moored to  
the Patoka

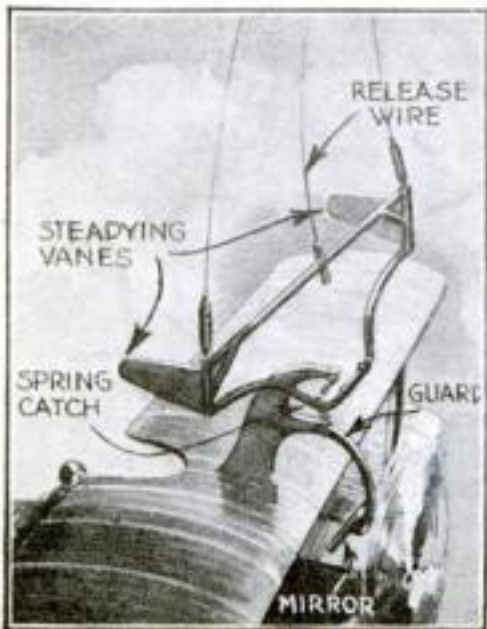


Above is seen the great dirigible *Los Angeles* under tow for the first time by U. S. S. *Patoka*, the only ship in the navy equipped with a mooring - mast. This test took place recently in Chesapeake Bay and, like previous tests between the *Patoka* and the *Shenandoah*, was entirely successful



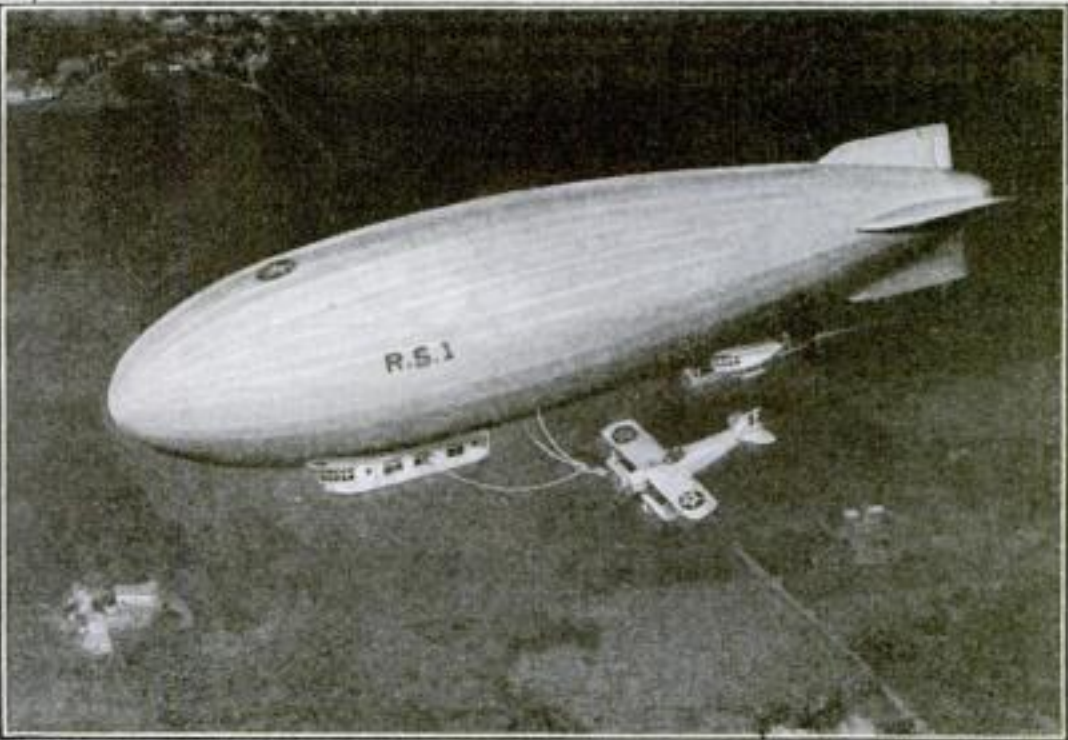
The *Los Angeles* remained moored for 45 minutes while the *Patoka* steamed up the bay. Then storm warnings caused the dirigible to return to her hangar at Lakehurst, N. J.

Effecting a contact between a dirigible and a mooring ship is a difficult and complicated operation. Here the *Los Angeles* is shown being hauled by cable toward the ship's mooring-mast



## Plane-Catcher

How England purposes to enable the dirigible R-101 to pick up airplanes in flight. Guided by a mirror, the pilot maneuvers his plane until a spring catch on the wing engages a special cable device lowered from the airship



Artist's conception of the R-51, the first semi-rigid dirigible ever constructed in this country, now being assembled at Belleville, Ill. This ship will be able to launch scout planes and pick them up again

28370

28185



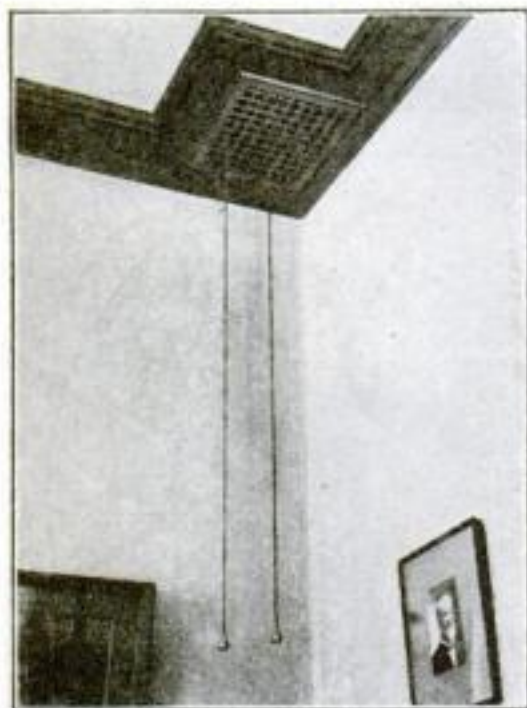
# Weather Man Makes His Own Climate



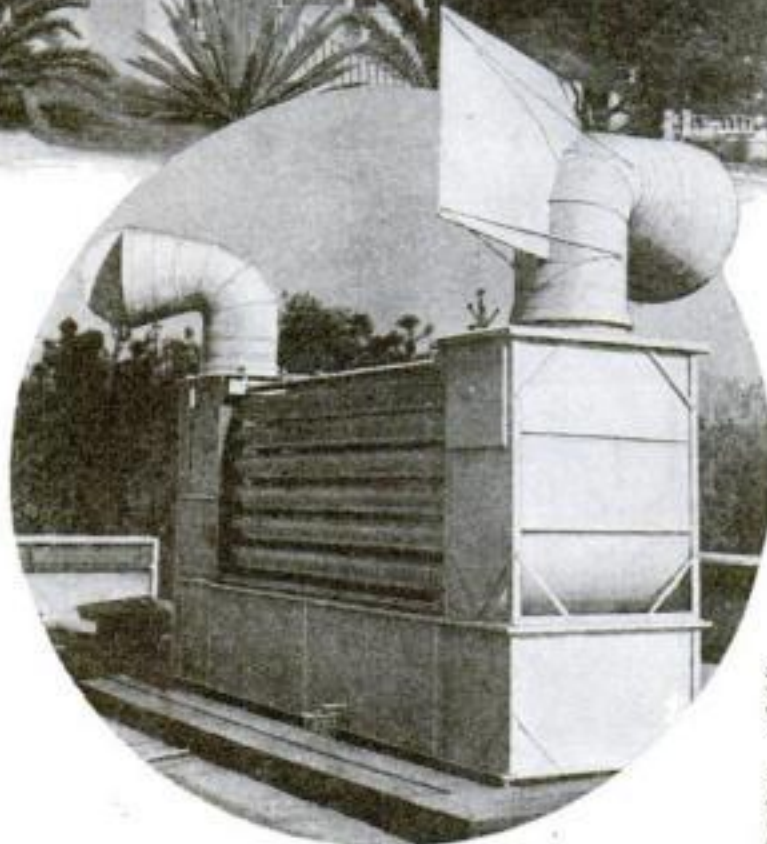
Professor Moore's home with air-purifying device on roof is shown above. A closer view (at right) shows the two funnels, one turned toward the wind. Air is forced through water in the large metal box



The inventor comparing the percentage of humidity of the air out of doors with that inside the house



Air enters through unobtrusive ceiling registers. The amount of air admitted can be regulated by pulling the cords that can be seen above hanging from the register



**A**S CHIEF of the United States Weather Bureau in Washington from 1895 to 1913, Prof. Willis Luther Moore studied weather and climate closely. He was especially interested in humidity. When he built a home in Pasadena, Calif., recently, he installed in it a unique system of ventilation.

On his roof he built a water-cooling device for humidifying and purifying the air. A large intake funnel is faced to the wind by

means of a weather-vane. Air from this funnel is forced through water and thence carried to all rooms of the house through ventilation pipes. A smaller funnel, which carries off the used air, is faced away from the wind.

Each room has two ventilators in its ceiling. One admits the fresh air and the other takes off the impure air.

In one test of the system Professor Moore found that with an outside humidity of 41 per cent the inside registration was 74 per cent. The percentage can be regulated to suit the convenience of the dwellers, he says. The system is applicable to any climate. With proper furnace control and a means of regulating humidity, such as this system affords, ideal home climate is possible in any weather.

Physicians agree that high relative humidity in the atmosphere of a home is of vital importance in preserving health.

## Actors Radio Play to Deaf

**O**NE hundred deaf persons, who could not have heard a word without mechanical help, were guests recently at an unusual theater party in New York City. Installed in various parts of the theater was an adaptation of the public-address



A scene in the play heard by a deaf audience. The microphone is concealed. At right: Persons in the audience equipped with head phones



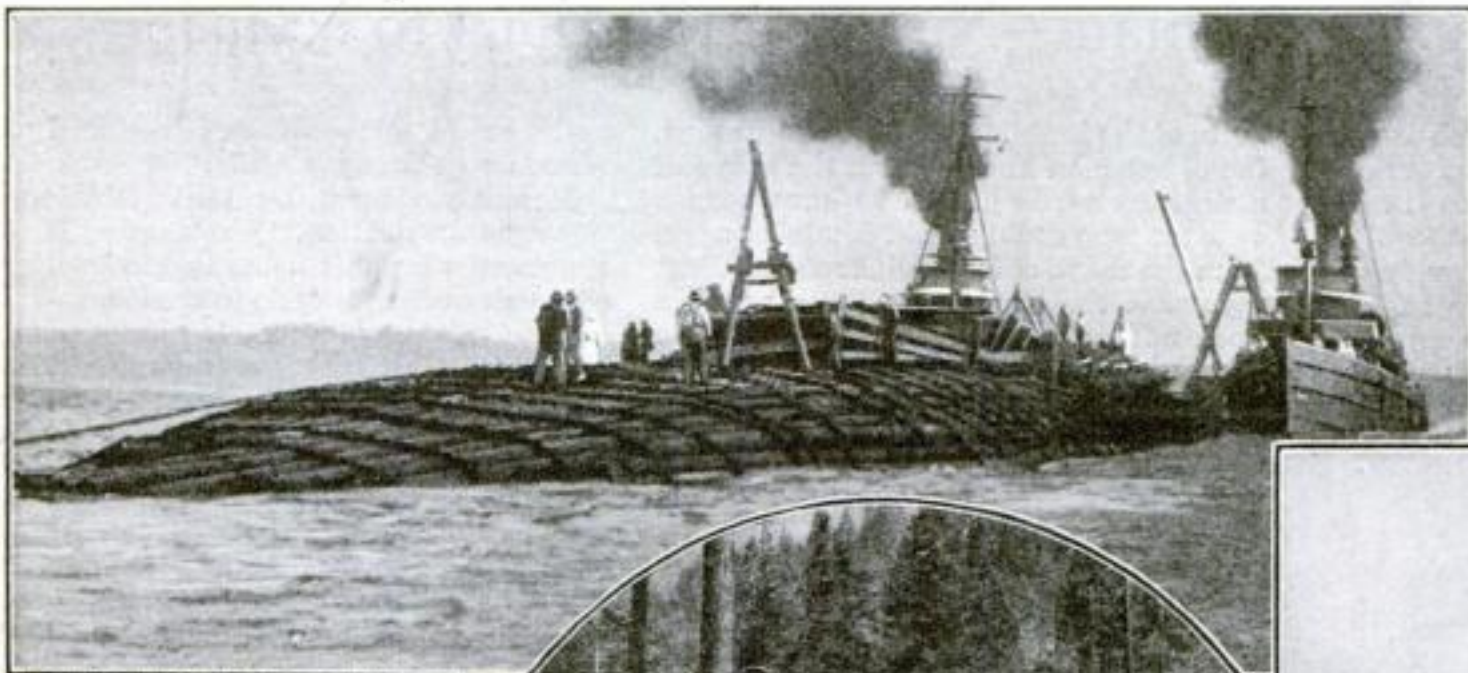
system that speakers use when addressing huge crowds.

The system consisted of microphones on the stage to pick up every sound, a vacuum-tube amplifier and 100 sets of head phones for those more seriously deaf. The listeners to whom a play had been nothing more than a "movie" previously, reported that they heard every word. They are hopeful that the experiment will open the doors of the theater to thousands to whom, until now, they have been closed.



# Where the Big Trees Crash Down

## The Mechanics of Lumbering—A Dramatic Story in Pictures



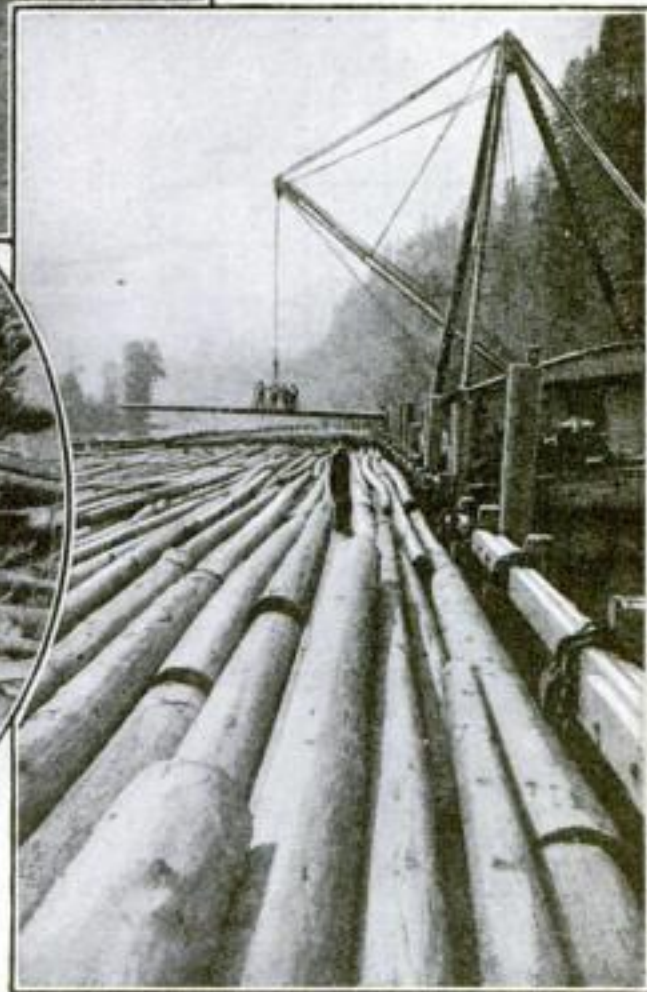
### Largest Timber Raft

Large-scale operations by which timber is being shorn from our forests are pictured here. The timber raft at the left is said to have been the largest ever constructed, containing more than 5,000,000,000 feet of logs. It was towed 1000 miles from the Columbia, Ore., to San Diego, Calif.



### Starting for the Mill

After the California big trees are felled, they are cut into mill lengths for transportation to the sawmill. This tree, which has started for the mill, is almost 10 feet in diameter



### A Raft 720 Feet Long

This huge cradle raft of Douglas fir, shown under construction on the Columbia River at Stella, Wash., is 720 feet long. The logs, held by the cradle, form an immense barge



### The End of a Giant Sequoia

Felling a giant California sequoia tree such as this is a task that requires great skill as well as brawn. The enormous girth of this tree may be appreciated by comparison with the two lumber-jacks seen at work

### From Forest to Mill

Piled on flat cars, these great logs are shown on their way from Washington forests to the sawmill. So the big trees are disappearing rapidly. The original forests of the United States, according to recent estimates, have been reduced from 5,200,000,000,000 board feet to 2,200,000,000,000, or more than half





# The "Missing Link" at Last?

Discovery of ape-man's skull may prove theory that Africa is the birthplace of man—New contributions to science

**I**N THOUSANDS of research laboratories, in countless shops, in the fields, forests, mines—even in the farthest corners of the earth—the workers of science are on the job every day for you. The volume of their achievements in making your life more enjoyable and freer from the sufferings of want and

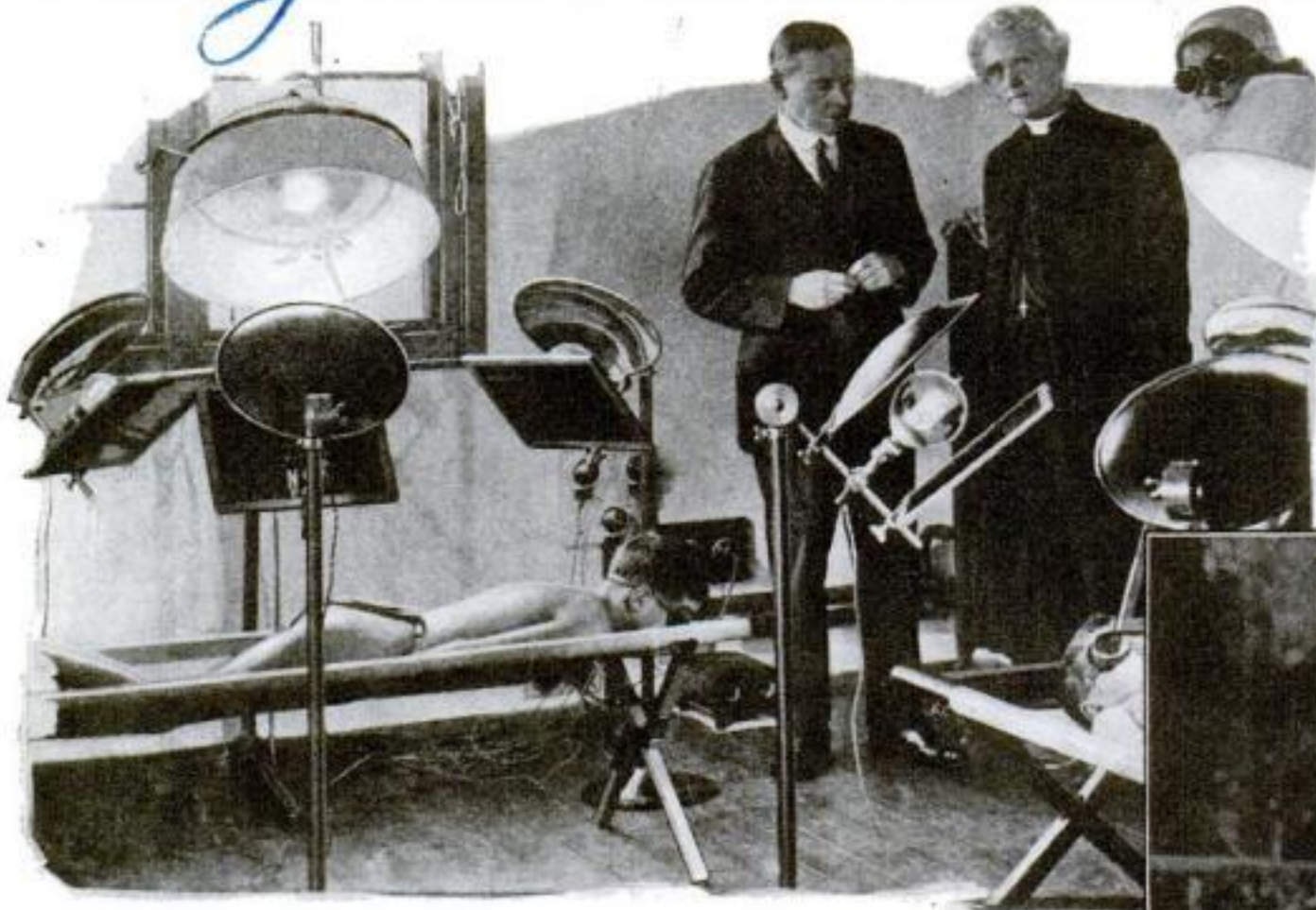
parts of the brain. The Pithecanthropus, the oldest man known, from the shape of a skull found, is judged to have been a creature who could speak. Judging again from the shape of its skull, Professor Dart says that the newly discovered manlike ape could not yet speak, but had a brain much more developed than that of an ape.

male or female and was destined to remain so throughout life.

Recently, though, Dr. Oscar Riddle, of Carnegie Institution, Washington, D.C., suggested that this belief in the unalterable fixity of sex is open to question.

Some years ago a female pigeon in the Carnegie Institution's laboratory at Cold Spring Harbor, N. Y., developed a disease that caused the degeneration of its sex gland, female birds having but one. This gland was on the left side of the pigeon's body. In a short time a male gland began to develop on the right side of the bird, and before long the pigeon actually had turned into a male.

Experiments performed by Doctor Riddle and others on other pigeons indicated that the sex of birds might be changed more or less readily. It was noted, more-



## Natural and Artificial Sunlight Combined in New Treatment

The beneficial effect of ultra-violet rays, or artificial sunlight, in the prevention of disease, especially of rickets among children, has been demonstrated repeatedly by American and European scientists during the last year. Now the U. S. Bureau of Standards has determined by tests just completed that as a germ-killer the ultra-violet ray acts almost instantaneously. Bacteria of the kind found in sewage were killed in less than a second after exposure to the rays. The above photograph shows Dr. Murray Levick, a British pioneer in the use of sunlight for healing, demonstrating his new apparatus for combining natural and artificial sun rays in the treatment of children. Note how reflectors are placed above the patient.

disease is far beyond recording. Some of them remain forever unknown to fame.

On these pages are simply a few of the month's most important contributions to the world's useful scientific knowledge.

## Ape-Man's Skull Found

**D**ESCRIBED as the long sought "missing link," a skull found recently at Taungs in South Africa, is considered by some scientists as the most important anthropological discovery ever made. The skull is that of a creature with an intelligence rated between that of a man and an ape, filling in the important gap that so long has proved a stumbling-block in the explanation of evolution.

Professor Raymond Dart, the noted Australian scientist, who found the skull in a limestone mine, has named the creature linking men with apes, "Australopithecus Africanus."

The difference between men and animals is associated with the size of certain

That is, the brain was enlarged in those parts associated with human characteristics.

The skeleton remains consist of two fragments. One is a brain cast, which is complete and whole. The other is the face of the skull, which was found completely embedded in the limestone of an old cavern.

An interesting feature is that the discovery seems to support Darwin's belief that Africa was probably the original home of the human family.

## Can Sex Change?

**S**CIENCE always has held that sex was a matter determined at the very beginning of life by certain cell structures known as chromosomes; that long before birth the expected arrival was fated to be either



## Mammoth Flower Shows Amazing Growth

Studying the amazing growth of this titanic flower, called "amorphophallus," botanists recently discovered that it reaches the height of eight feet in a little more than a month. The plant is a native of Sumatra. When the blossom is full blown it has an extremely unpleasant smell. Its full magnificence lasts for only three days, when it collapses. The photograph is reproduced by courtesy of Mr. P. Dakkus, who is curator of the Botanical Gardens at Buitenzorg, Java.



over that male glands developed on the right side much more than on the left.

From these experiments sex changes have been brought about long after birth. Doctor Riddle suggests not only that the sex of an animal may not be the unchangeable thing it always was believed to be, but that, depending on the sex, the degree of sexuality is greater on one side of the body than on the other.

Supporting this new suggestion that the difference between the sexes actually hangs on a most slender thread are experiments recently conducted by Prof. Frank R. Lillie at the University of Chicago. By a simple gland operation, performed on several hens when young, he has caused them to acquire virtually all the characteristics of male birds.

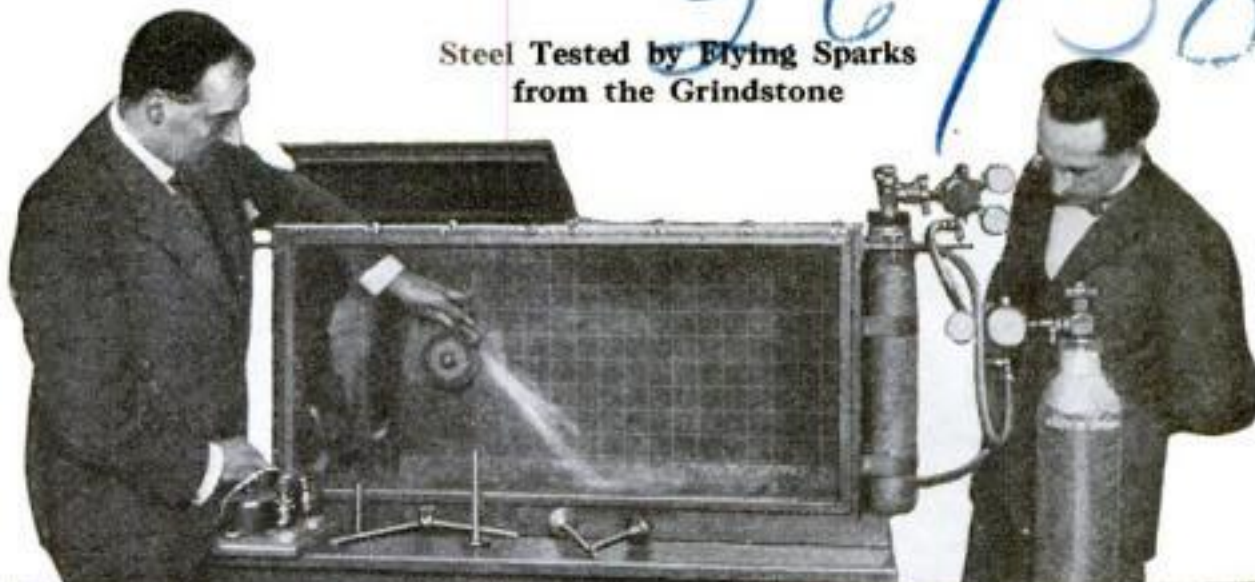
## New Antiseptic Stronger than Carbolic Acid

**M**EDICAL men long have dreamed of discovering some universal antiseptic which, taken internally, would destroy all the disease germs in the body, providing virtually a panacea for human diseases. Now this dream seems closer to fulfilment with the recent development of a marvelous germicide, said to be 50 times more powerful than carbolic acid, yet so harmless that quantities of it may be swallowed without injury.

The discoverer of the new antiseptic, called "hexylresorcinol," is Dr. Veader Leonard, Chairman of the Clinical Committee on Antiseptics of the National Research Council. He and his associates spent 10 years in developing it in the Johns Hopkins School of Hygiene and Public Health, Baltimore, Md.

In the experiments the antiseptic was first fed to rabbits. When the animals suffered no ill effects, Doctor Leonard and the six men working with him took it in increasing doses, and eventually were convinced that it was harmless. It was then that hexylresorcinol was successfully applied at Johns Hopkins Hospital for the treatment of patients suffering from infections of the kidneys and of the urinary tract. In some cases, kidney infections of long standing were cleared up in 48 hours, according to the hospital records. The cures appeared to be permanent, it was said.

To determine just how far-reaching may be the application of hexylresorcinol to disease in general, a committee of 15 scientists has been appointed by the National Research Council to work with Doctor Leonard in further research.



Steel Tested by Flying Sparks from the Grindstone



Photographs of sparks flying from metal on a grindstone are employed in a new and exact method of testing steel invented by E. Pitois, a French aeronautical engineer. By this method, he claims, even the amateur can determine the degree of hardness and purity.



Sparks are photographed on a black background at very close range, and the images thus obtained are enlarged, revealing distinguishing formations that are said to determine the metal's quality. The pictures show the new apparatus and spark photographs

## Niagara's Wasted Power

**T**WO and a half million horsepower are constantly going to waste at Niagara Falls, according to a report made re-

cently by Samuel S. Wyer, associate in mineral technology of the Smithsonian Institution. This represents 87,800 cubic feet of water, which flows over the falls every second and which might be diverted for power purposes, he states, without marring the scenic beauty of the falls.

The total volume of water flowing over the American and Canadian Falls is 205,000 cubic feet a second, of which 94 per cent is carried by the Canadian side. At present 56,000 feet is diverted for water power and 11,200 cubic feet feeds the Chicago Drainage Canal, the Welland Ship Canal, and the New York State Barge Canal. This leaves 137,800 cubic feet, of which, Mr. Wyer maintains, only 50,000 is needed for scenic beauty. The remainder, he states, may be "harnessed."

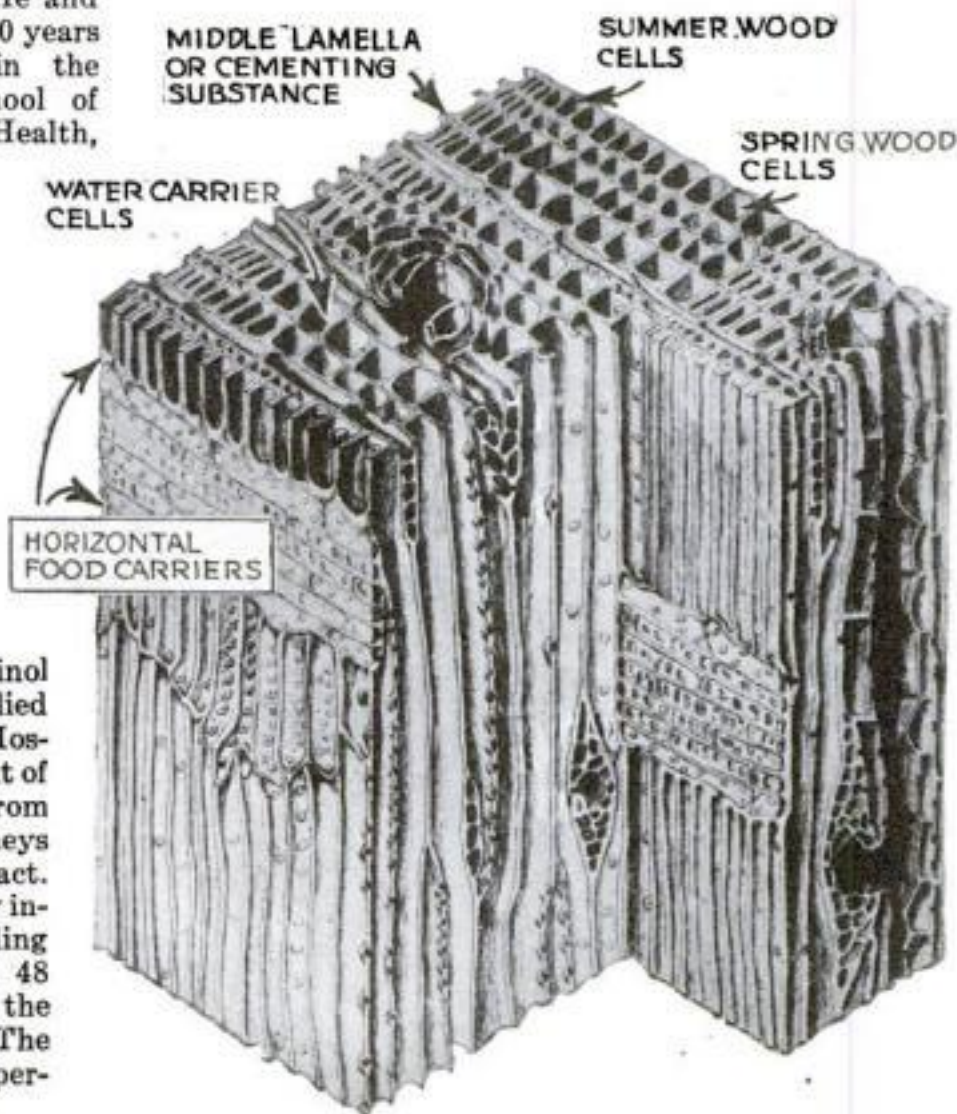
Further water-power projects at Niagara Falls are impossible under the present treaty with Canada, which limits the amount of water that can be diverted for this purpose to 56,000 cubic feet, producing about 1,000,000 horsepower.

## The Work Your Eyes Do

**M**OST of us realize the importance of good eyesight; few, though, probably know to what extent we employ our vision in our daily work. In a recent test conducted by a commercial concern studying problems in illumination it was determined that the ordinary run of indoor workers—clerks, machinists, printers and the like—use their eyes 70 per cent of the time they are at work.

Among 20 occupations that may be classed as "close work" it was found that in only six did the necessity for close visual application fall below 50 per cent of the working day.

The object of this eyesight test was to determine how much the production of workers may be increased by better illumination without placing an undue tax on their eyes.



## Secrets of Wood Disclosed by Microscope

This remarkable diagram of the cell structure of a block of white pine wood, recently produced with the aid of a microscope, reveals that wood, instead of being relatively solid, is really composed of many tubular cells cemented together. The walls of the vertical cells, which are water carriers, form the bulk of the wood substance. Running at right angles to them are horizontal cells that store and distribute food material. Spring wood cells that form during the early growing season, and summer wood cells produced toward the end of the season, together form one of the annual rings by which the age of the tree is told.

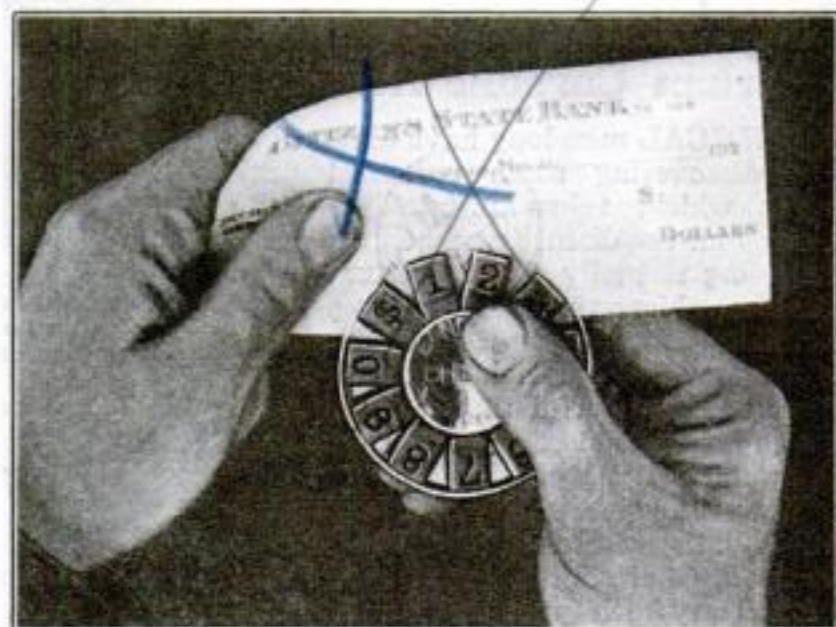


# Ten New Inventions for

## Pocket Check Protector

A CHECK protector, small enough to be carried in the vest pocket, is a recent invention for the convenience of business men who are careful to prevent raising of their checks. It includes all the numbers needed, the cipher, and the dollar sign. There is an ink pad between the lower and upper plates.

When a check is inserted and the protector pressed, fine sharp pins prick holes in the check and these are filled with fluid from the pad. Any erasure on this inked number can be detected easily. For additional protection specially designed figures can be used on the device.



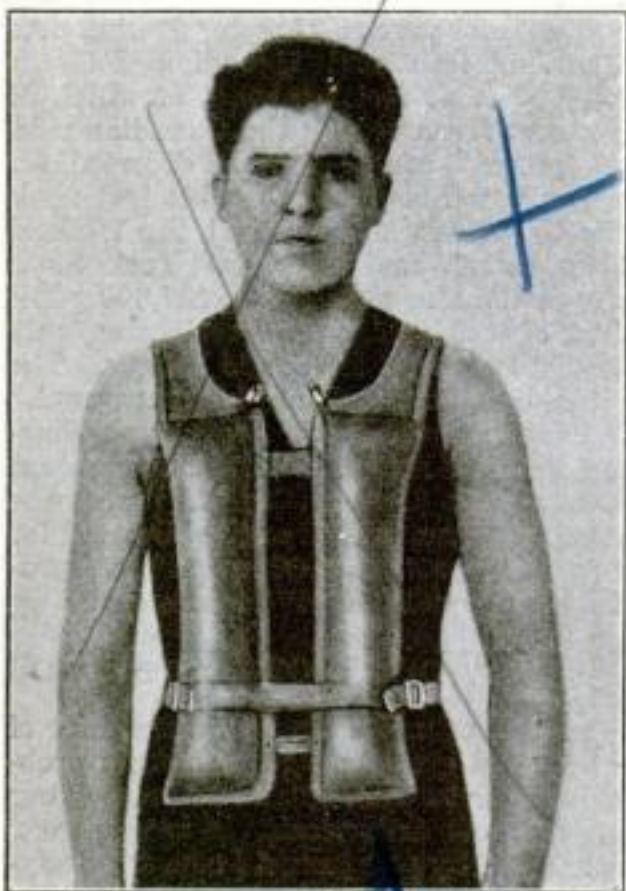
The protector perforates check and fills holes with ink

## Rural Mailbox Stand Revolves

A REVOLVING metal stand, holding from two to 12 mailboxes, saves space and time for the postman delivering rural mail near Livermore, Calif.

In order to do away with unsightly rows of individual mailboxes set on posts at crossroads, groups of farmers in many communities fix their mailboxes to large discarded wagon wheels set on the ends of fence posts. The newly invented metal stand serves the same purpose and helps to keep the highway more attractive.

The sides of the device can be used for posting small local notices. Mounted at the top of the center post on which the supporting frame revolves is a small road sign in the form of an arrow.



## Inflated Safety Belt for Bathers Fits Tightly

WEIGHING little more than a pound, this inflated safety belt for bathers fits over the shoulders and straps securely around the body. It has four large air chambers, two in front and two in back, with vulcanized seams.

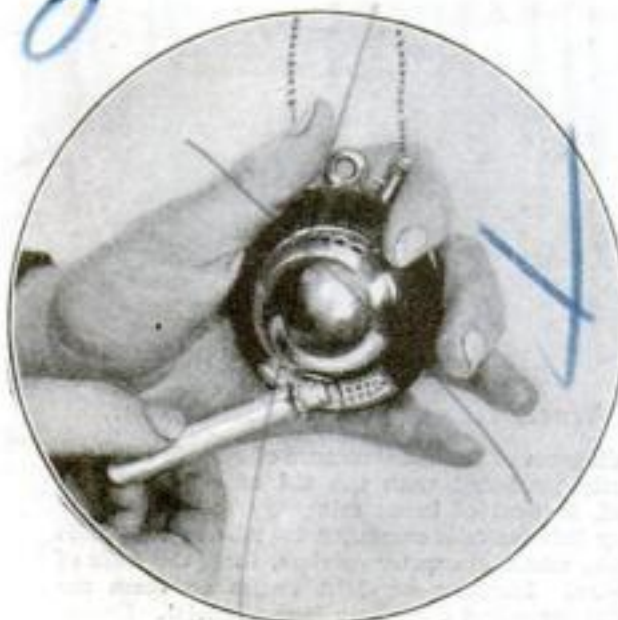
Once adjusted, it cannot come loose, the manufacturers claim, and it interferes in no way with the movements of the bather. An air valve controls the inflation.

AN ELECTRICAL process for manufacturing carbon black, a pigment widely used for such purposes as printer's ink and carbon paper, recently has been devised by the U. S. Bureau of Mines. The present process uses natural gas.

## This Novel Fire Alarm Rings the Door-Bell

ONE of the latest fire-alarm devices is connected with the electric door-bell circuit of a house, so that if a fire starts, it sends out a warning by ringing the bell.

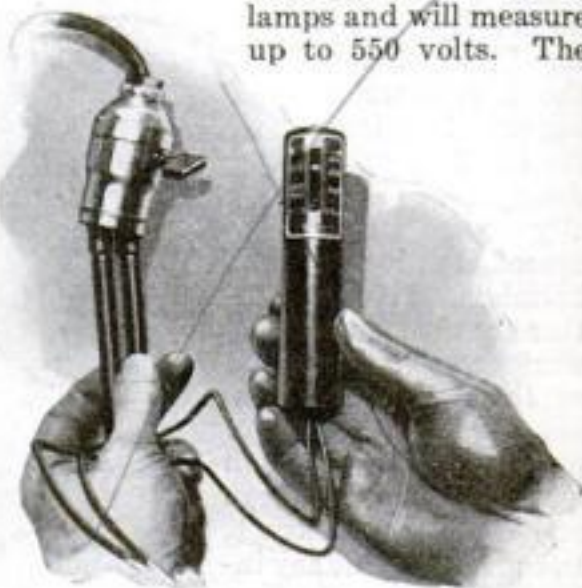
In the photograph below the alarm is being tested with a lighted cigarette. Within from 30 to 60 seconds after the heat is applied the inventor claims it will start the door-bell ringing.



A cigarette sets off the fire alarm

## New Voltage Tester Tells the Kind of Current

TO TELL whether an electric current is alternating or direct, as well as to measure its voltage, this new type of voltage tester has been designed. It does not require the use of lamps and will measure up to 550 volts. The



Testing voltage from a light socket

apparatus is inclosed in a rugged fiber housing.

A magnet coil operates a plunger against the tension of a spiral spring. The position of this plunger on a scale indicates the voltage. Pointed hooks in fiber-insulated handles at the end of long wires make it easy to get the lead wires into the circuit.

The photograph shows the device being used to test the current from an ordinary electric-light socket.



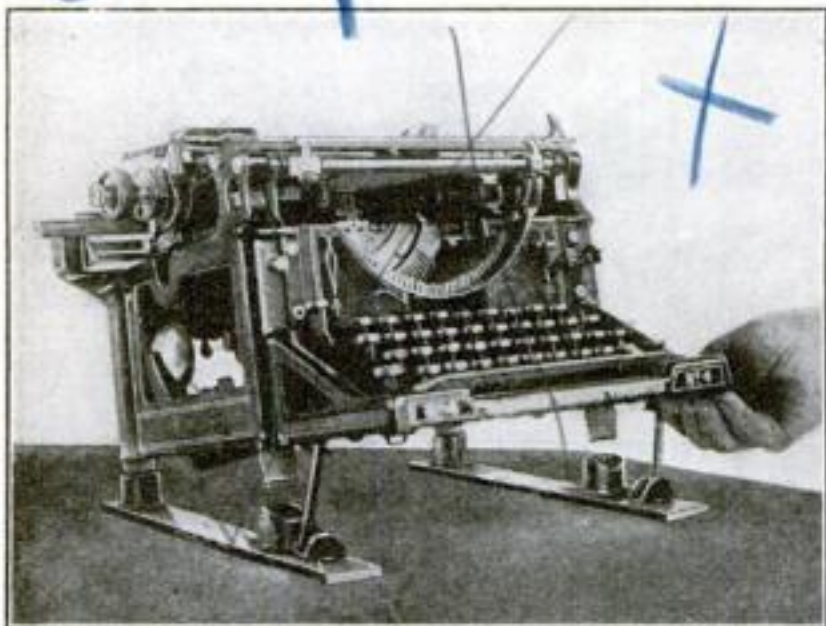
# Our Every-Day Use

## Typewriters Silenced

**T**YPEWRITERS fastened to desks with newly invented shock-absorbing attachments are said to become practically noiseless and rattle-proof, thus saving wear on the machine as well as on the nerves of office workers.

The rubber feet of the typewriter fit into sockets of the attachments, where they rest on felt-covered coil springs. The machine is held firmly by automatic hooks that engage the frame as the legs are inserted in the sockets, and is released simply by pressing back the hooks.

Parts underneath the machine remain accessible for cleaning or repair.



How the typewriter legs rest on four shock absorbers



## A Push Opens New Typewriter Desk

**A** SLIGHT push brings the platform of this new typewriter desk into position. The lid is raised halfway before the typewriter platform moves, then a straight push backward brings the typewriter into place, making the operation easier and simpler, it is claimed, than that of the ordinary drop-head typewriter desk. The platform locks automatically into position.

Rigid supports prevent the platform from shaking, and ample knee room is provided for the operator, whether the desk is open or closed.

## Special Pen Marks Packing Cases with Ink

**A** DDRESSES and marks made with a crayon or pencil on packing cases and bales often rub off so that they are illegible. Much more permanent marks may be put on with ink, it is claimed, with a special pen invented recently for that purpose.



The marking pen is held upright

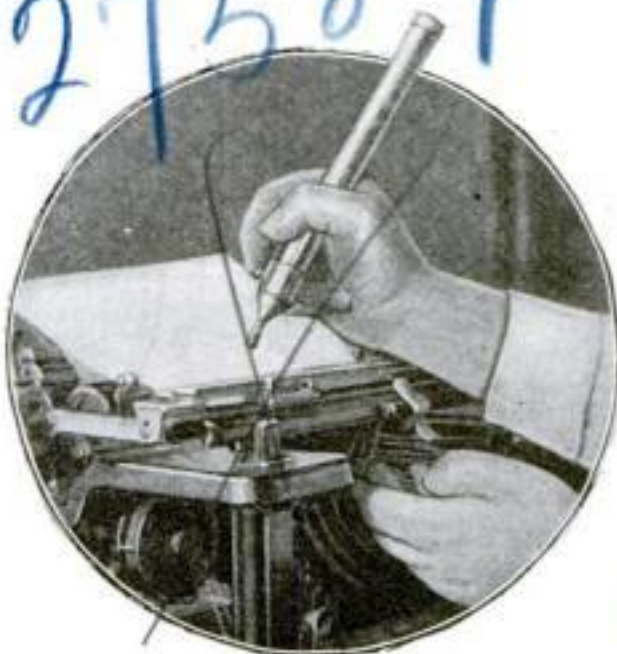
The flow of ink depends upon the pressure on the rubber nib. Any good ink may be used. The writer uses it like an ordinary pen, but holds it a little straighter. The pen can be used, also, for writing display cards or window signs.

A JOURNEYMAN baker in Paris, France, claims to have discovered a formula for bread dough that will keep the loaves in edible condition for months, or even for years.

MAKING synthetic rubber has resulted recently in the discovery of a synthetic chemical substitute for cocaine. Tuto-kain, the new compound, is made from the intermediate products. It is said to be effective as a local anesthetic.

## Self-Feeding Brush Aids in Cleaning Type

**T**O DO away with the rather mussy method of cleaning typewriter type with brush and pin, a self-feeding typewriter brush has been designed. It consists of a hollow metal handle containing type-cleaning fluid, which is fed into an adjustable bristle brush. The fluid is applied by pressing a pump button.



A typewriter brush shaped like a pencil



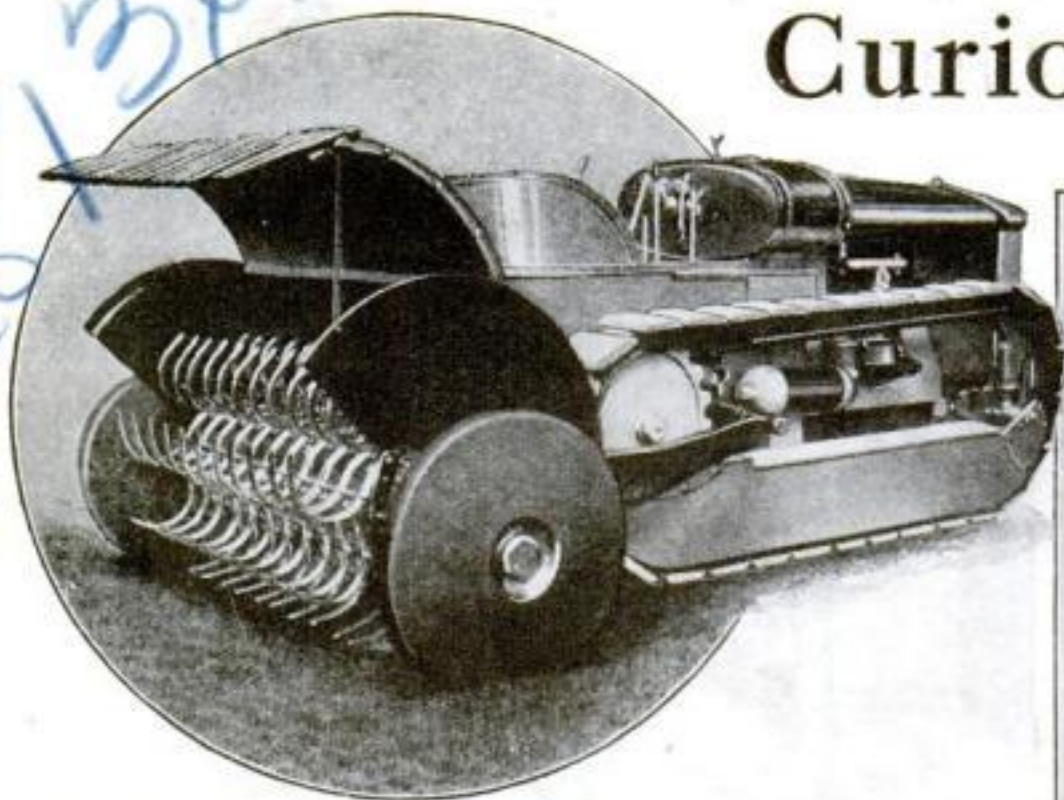
## Combination Lock Invented for House Doors

**T**HIS ingenious door lock works like the combination of a safe. The key is inserted permanently in the lock, which has a set of buttons around its outer edge. It can be turned only when the proper set of buttons has been depressed.

To bring the buttons back to their original position, the key is pulled outward after the door is opened, and the lock is again ready for service.

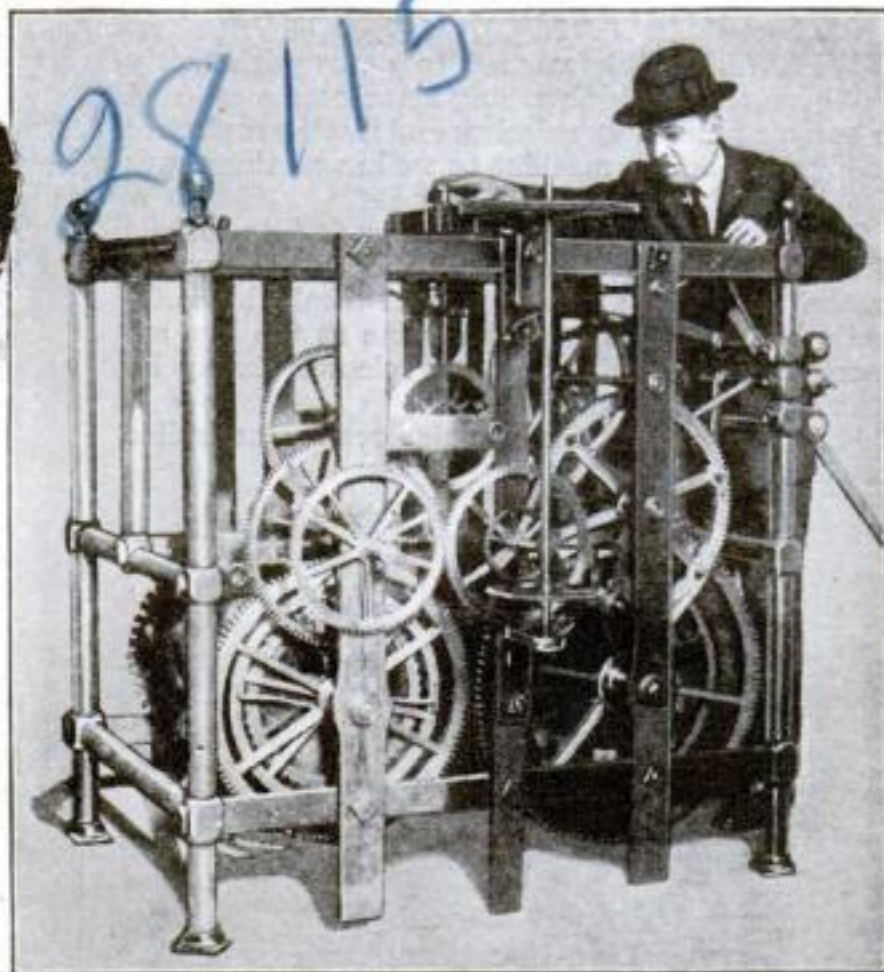


# Curious, Useful and



## Caterpillar Tractor and Plow Combined

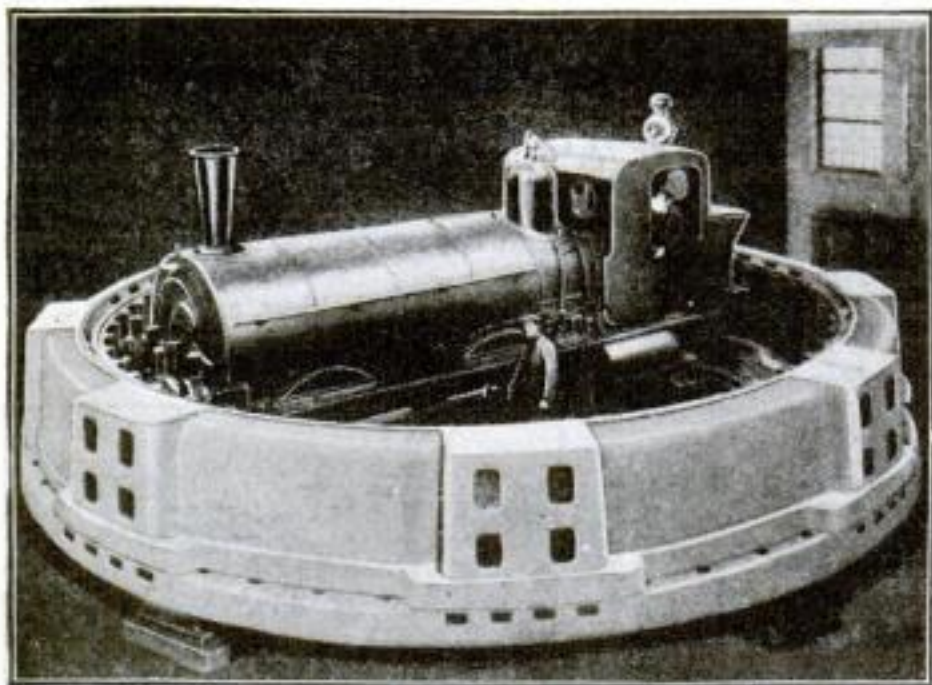
One of the most compact farm implements exhibited at a recent German motor show was this tank-plow, said to be the first machine to combine caterpillar tractor and plow in one unit



© U. & U.

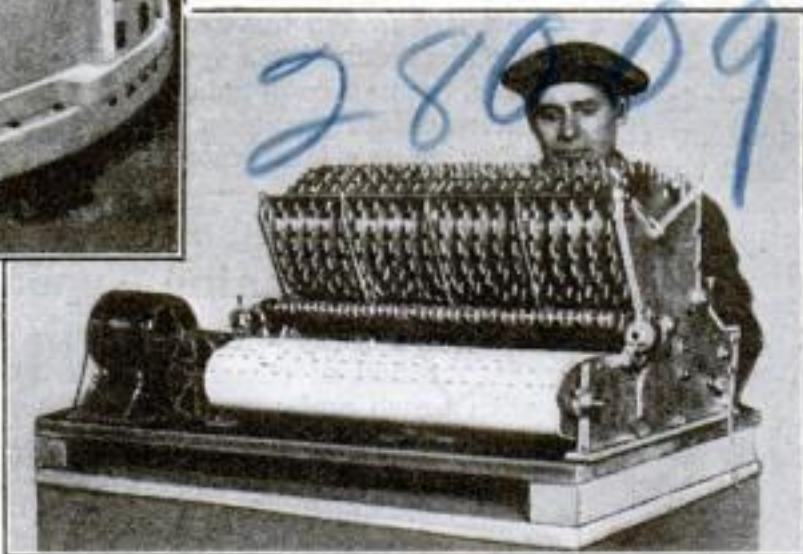
## These Wheels Have Run Nearly a Century

For nearly a century these clock wheels have been keeping good time. The clock was built in 1828 by Isaiah Quimby Lukens, and for nearly 50 years recorded time in Independence Hall, Philadelphia. It was remounted recently in the attractive new town hall at Germantown, Pa.



## Mammoth Dynamos for Russia

There is room for a fair-sized switch engine within the stator of one of the huge generators comprising a new power plant that is to supply the city of Leningrad, Russia, with light and power. Four of these immense dynamos, each of 11,000 volts, already have been delivered by the Swedish General Electric Company



## A Machine that "Thinks"

If you ever have tried to score an automobile race, you will appreciate the complexity of a new machine that keeps an accurate printed record of each speeding car and supplies a complete analysis of the contest

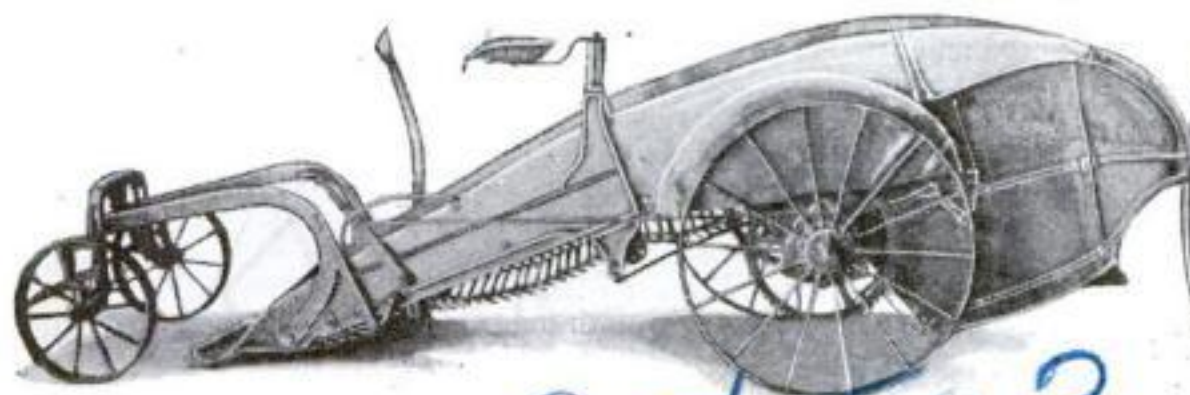
## Like a Huge Mosquito

A remarkable new machine for digging post holes can bore a hole three feet deep and nine inches in diameter in 30 seconds. A pull on a lever is sufficient to start the drill downward. Another pull stops it at the desired depth and brings it back to the starting point. The inventor, Otto Coil, of Washington Court House, Ohio, built his original model from 23 pieces of farm machinery





# Ingenious Machines



## Boat Runs on Rails

One of the world's queerest boats, when it reaches land, climbs out of the water on rails and propels itself like a train on a track to its dock many feet from the shore line. It launches itself in a similar manner. This strange land-water craft is in daily service at Helsingfors, Finland's capital.

## Automatic Potato Digger

An improved labor-saving machine for the farm is a mechanical potato digger equipped with a revolving automatic dump that discharges the potatoes in windrows, convenient for the pickers to put in baskets. Side and rear views are shown in the illustrations above.



## A Gasoline Locomotive

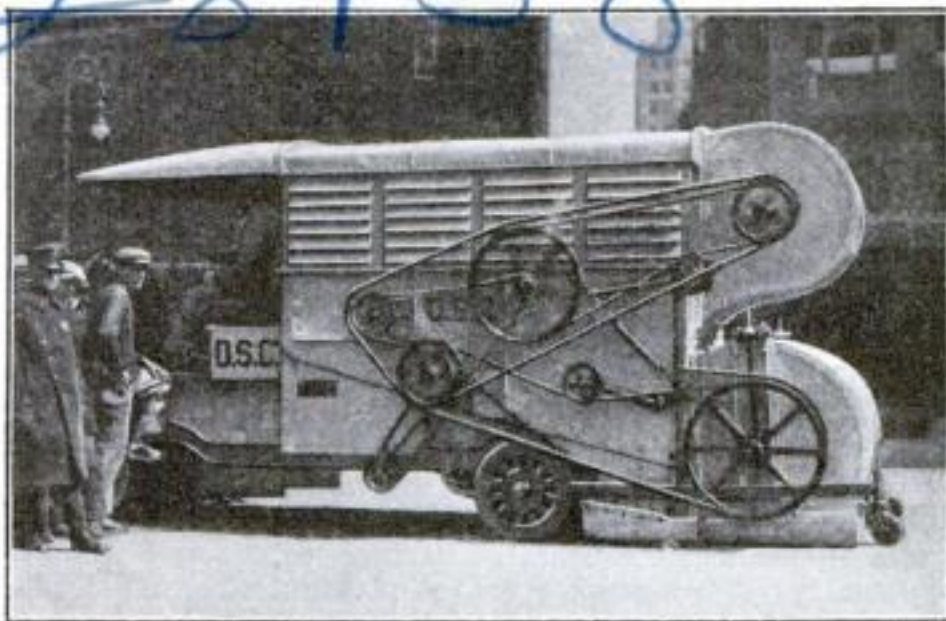
For heavy duty hauling service such as is required for mines, brick plants, and road construction jobs, an economical gasoline locomotive—a tractor on rails—has been perfected. It consumes about five gallons of gasoline a day.

## Vacuums Streets

The most modern of house-cleaning methods now is being applied to sweeping city streets. This mammoth vacuum cleaner recently invented, sucks up litter without raising dust, and sweeps without water.

## 200 Aboard

Just to demonstrate the immense proportions of a powerful new type of mountain locomotive, 200 men recently climbed aboard. More than 150 locomotives of this type are in use on a Pacific Coast railway.





## Electric Handsaw Has Many Uses



A carpenter using the electric saw on the job

A NEW portable electric circular saw enables workmen to do power sawing on the job with speed and accuracy. It is said to cut satisfactorily wood, wallboard, plaster board, fiber, linoleum, hard rubber, insulated cables, brass, and many other materials. It can be used also in the packing industry for cutting meat.

Since the body of the saw is of aluminum the tool is light in weight and easy to handle. It has a cutting capacity of two inches in hard wood and has attachments to be used for beveling or other similar purposes.

The air-cooled motor is placed directly back of the saw. This runs only while the operator holds his finger on a contact trigger switch in the handle of the tool. A guide in front of the saw enables it to cut on the line straight and clean, eliminating costly trimming operations. The tool can be run from a wall socket.

A NEW combination plier and wrench designed for many uses, can grip anything, from a cotter-pin to a nut on a three-quarter-inch bolt.

## New Polishing Tool Has Inflated Wheel

A PNEUMATIC wheel for grinding, buffing, and polishing, designed to speed up work along these lines, has just been put on the market. The wheel is inflated by means of a valve, just as an auto tire is inflated. The grinding surface is removable.

Sandpaper, emery, or any other abrasive surface can be attached to suit the convenience of the user. The grinding strips are held by a flange.

The operator pushes the tool along the surface of the work exactly as a plane is manipulated, the wheel being motor-driven.

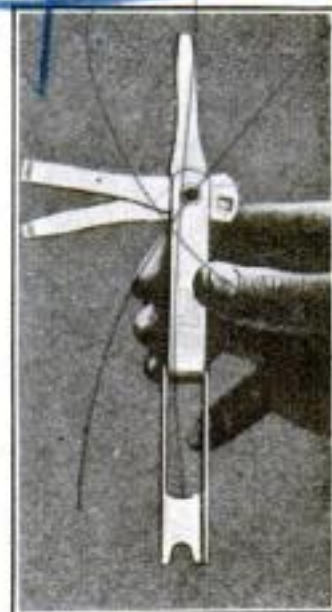


The abrasive surface is attached around the circumference of the wheel, which is inflated

## Handy Pocket Screwdriver Has Folding Blades

NEXT to a knife, a man finds himself more often in need of a screwdriver, probably, than of any other tool used for ordinary purposes.

A Michigan manufacturer recently has developed a folding screwdriver that can be carried in the pocket with one's knife. Three blades of different sizes lock open separately, giving the compact tool a wide range of usefulness. When the blades are not in use, they are locked tight in the handle.



## Finds Way to Store Surplus Steam for Future Use

A SIMPLE device that enables surplus steam produced during slack hours to be stored in a reservoir until the time of peak load brings a need for it, has been devised by a Swedish engineer, Dr. Johannes Ruths.

In recognition of his valuable invention, the Swedish Academy of Engineering Science awarded the inventor a gold medal.

The steam accumulator is a large cylindrical tank with spherical ends, filled with water to 90 or 95 per cent of its capacity. Steam not needed at the moment for the engines is passed into the remaining space, where under the pressure it condenses to superheated water. Later, when more steam is needed than the boilers can supply, the water level in the tank is lowered, decreasing the pressure, and releasing the steam. Loss of temperature is prevented by a heat-insulating wall built about the tank.

## Automatic Machine Saves Time and Labor in Truck Loading

WHILE only one man is needed to drive a delivery truck when heavy merchandise is carried, an additional man is required to load or unload it. Double expense therefore is incurred on trucking jobs, merely for the few minutes when loading or unloading is done. For some time manufacturers have been looking for a mechanical aid, so that material could be lifted into truck bodies by the driver.

A German engineer recently invented the automatic truck loader for barrels shown in the photograph. With this, it is said, one man easily can do the work of unloading or loading.

The device consists of a V-shaped tilting platform that slides up and down an inclined track lowered from the rear of the truck. This platform, or carrier, is operated by a hand winch on the side of the truck.

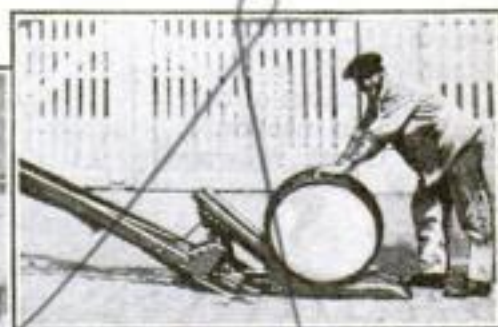
When a barrel is to be unloaded, it is rolled from the floor of the truck to the platform. Lowered to the bottom of the incline, the platform encounters a stop

that automatically tilts it in such a way as to discharge the barrel to the ground.

In loading, the operation is reversed, the barrel being rolled on the platform from the ground and pulled up the incline.

While the larger photograph shows two

men at work unloading barrels from a truck, it is quite apparent that the device would enable one man to handle the heaviest loads unaided.



How heavy barrels are discharged from a truck. The view at the left shows a barrel being rolled on the platform, which is lowered down the inclined track. At the bottom (above) the platform is tilted, thus discharging the load



## New Radio Wrench Spins Round Nuts Tight

ONE of the chief sources of trouble for the man who builds his own radio set lies in loosened connections. Small, round nuts in almost inaccessible places are particularly difficult to tighten sufficiently to insure good, permanent contacts.



The newly designed wrench shown in the illustration has sharp teeth tapered so as to grip knurled round nuts firmly, with but slight pressure. The long reach of the shank makes the tool especially useful,

and the handle gives strong leverage.

The shank is tooled from one piece of steel and hardened for constant service.

## Numbers Cylindrical Parts Automatically

AUTOMATIC numbering of cylindrical metal parts has been made available for machine-shops by the recent invention of a machine that also will stamp names and trade marks on the work at the same time that the numbering operation is performed.

The parts to be numbered are carried on a special holding fixture on the table to which the device is attached, and are rotated automatically into the correct position.

For ordinary changing of the numbers a hand lever is depressed to give the next highest number. The lever strikes a fixed point on the holding fixture, and automatically advances the numbering dies. This arrangement makes the device adaptable for serial numbering.

## With Powerful New Jack One Man Pulls a Steel Railway Car

FOR pulling and hoisting work, a powerful little machine called a "pulling-jack," recently invented, can be used in an amazing number of ways. Operated by one man, it is said to be

proving a great labor-saver, especially in house-wrecking and on railways.

It is declared to be capable of moving anything weighing up to 100 tons. With

the jack one man can pull down a whole brick pier, a wall, or chimney, ordinarily the work of many men. In the photograph the jack is being used to pull a derailed steel railway car back on the rails. For stump-pulling and moving heavy machinery it is said by the manufacturers to be very efficient.

The machine combines the principles of the lifting jack and winch. A pawl-and-ratchet mechanism is used to wind a cable on a drum. The jack can be operated at six different speeds.

## Cleans the High Lights in Shops and Offices

TO FACILITATE the cleaning of electric-light fixtures and reflectors located far from the floor, a new brush mechanism attached to a long handle recently has been perfected. A lever at the side of the handle holds the brushes against the surface to be cleaned, and a hand crank revolves the brushes.

## Railway Ties Dated with a Brand

A BRANDING outfit to mark railway ties is a new aid in keeping railway tracks in good condition. Railway companies usually keep records of the year in which ties are laid by marking them with special nails. These are inspected at intervals, and the oldest ties replaced by new ones. The nails, however, often are knocked off and the record destroyed.

The new branding device burns into the ties the date on which they are laid. It consists of a metal plate with raised numerals indicating the month, day, and year in which the branding is done. This plate is attached to a handle and is heated by a small torch. It can be used also to brand tools and other equipment.

Gasoline is the fuel used in the small torch, which will operate from 1½ to four hours, depending upon the use to which it is put. With special attachments, the torch can be used for heating a soldering iron or for a blowtorch.



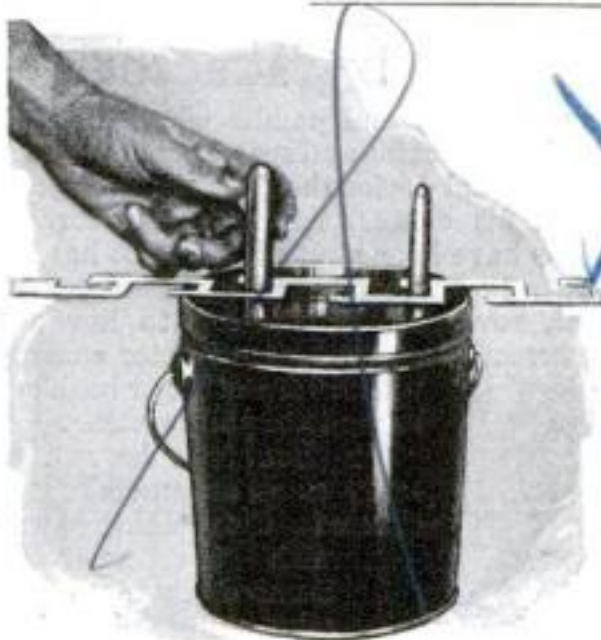
How the tool brands the date on a wooden surface

AN IMPORTANT advance in standardization has just been made in the adoption of standard screw threads by the American Engineering Standards Committee.

## Simple Rack Keeps Paint Brushes Pliable

IT IS a well known fact that paint brushes will last twice as long if they are properly cared for. To assist the professional painter, as well as the home worker, in keeping brushes in good working condition, the simple rack pictured at the left recently has been invented. It accommodates brushes of almost any size suspending them in water or whatever other liquid is used to keep the brushes soft and pliable.

The rack rests on the container, no matter what its size or shape, and forms a series of slots in which the brush handles are held.



One man pulls a railway car with the aid of the jack







Demonstrating a model of the proposed high speed monorail subway. Emerging from the station the car dips down into a deep tube

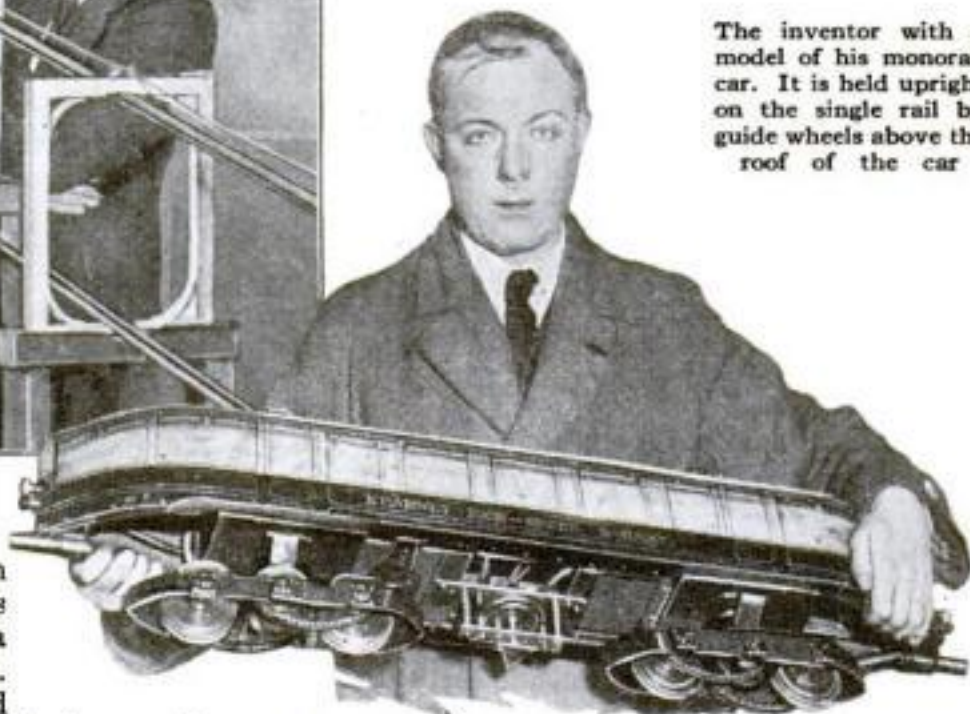
**A** HIGH-SPEED underground railway system in which cars running on a single rail could travel at the rate of 60 miles an hour, is the latest suggestion offered in England to solve the transit problems of large cities. A demonstration was given recently by means of working models by the inventor.

The proposed system would consist of stations just below the surface, connected

by deep tubes in which the cars would run on a single ground rail. They would be held upright by guide wheels running on a guide rail above. The wavelike course of the railway, the inventor believes, would serve to quicken the speed of the trains on departure and to retard them at the

## Monorail Subway Proposed in England

The inventor with a model of his monorail car. It is held upright on the single rail by guide wheels above the roof of the car



approaches to a station. For maximum speed, as well as comfort, the inventor has designed special streamlined cars.

## Odd River Ferryboat Driven by Tractors

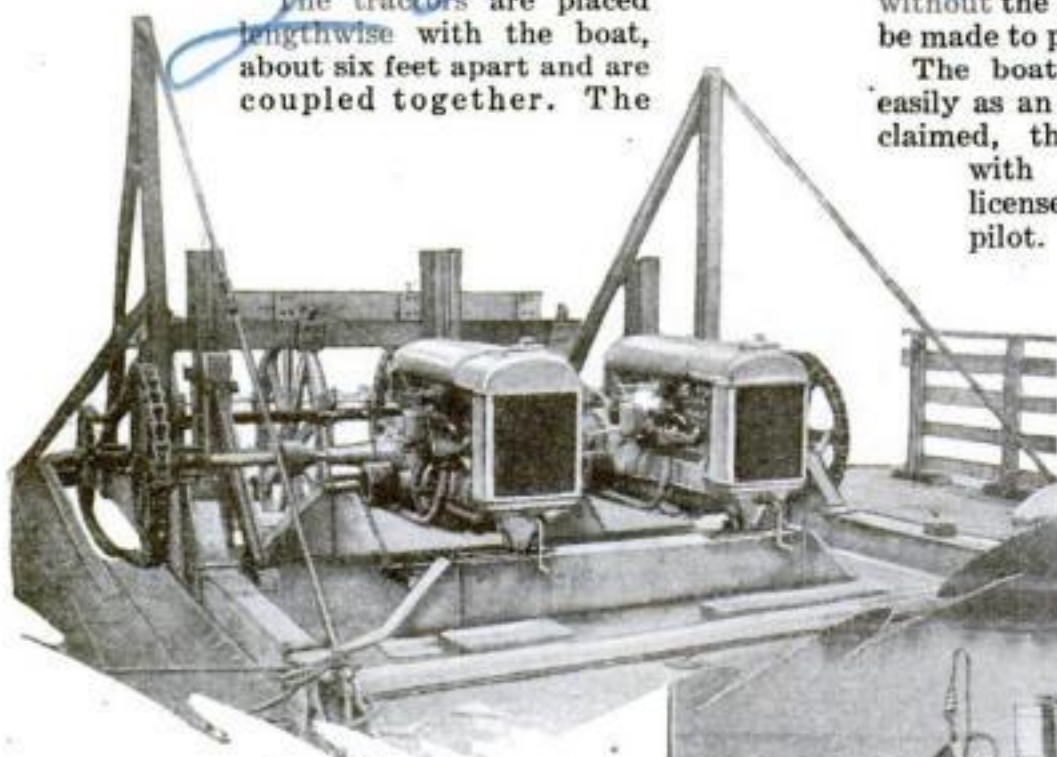
**I**N SPITE of old rivermen's prophecies that it couldn't be done, two Fordson tractors recently began operating a ferry on regular schedule on the Tennessee River at Paducah, Ky. Engineers who have examined the novel boat declare the power to be an improvement over steam for this purpose.

The tractors are placed lengthwise with the boat, about six feet apart and are coupled together. The

tractor shaft and paddle wheel are connected by chains and sprockets. By means of a special device the pilot can shift gears from his cabin. After the tractor engines have been started, the pilot has full control over them, stopping them in neutral, reversing, or shifting to low and intermediate gears. One tractor can run without the other or both can be made to pull together.

The boat can be run as easily as an automobile, it is claimed, thus doing away with the need of licensed engineer and pilot.

How the two tractors are geared to the stern paddle wheel. They are controlled from the pilot's cabin



## World's Greatest Tunnel

**T**HE greatest tunnel in the world soon will be built under the Mersey River in England to link the city of Liverpool with Birkenhead and adjacent towns on the south bank of the river. It will have an internal diameter of 44 feet, greater than the Hudson River tunnel now under construction.

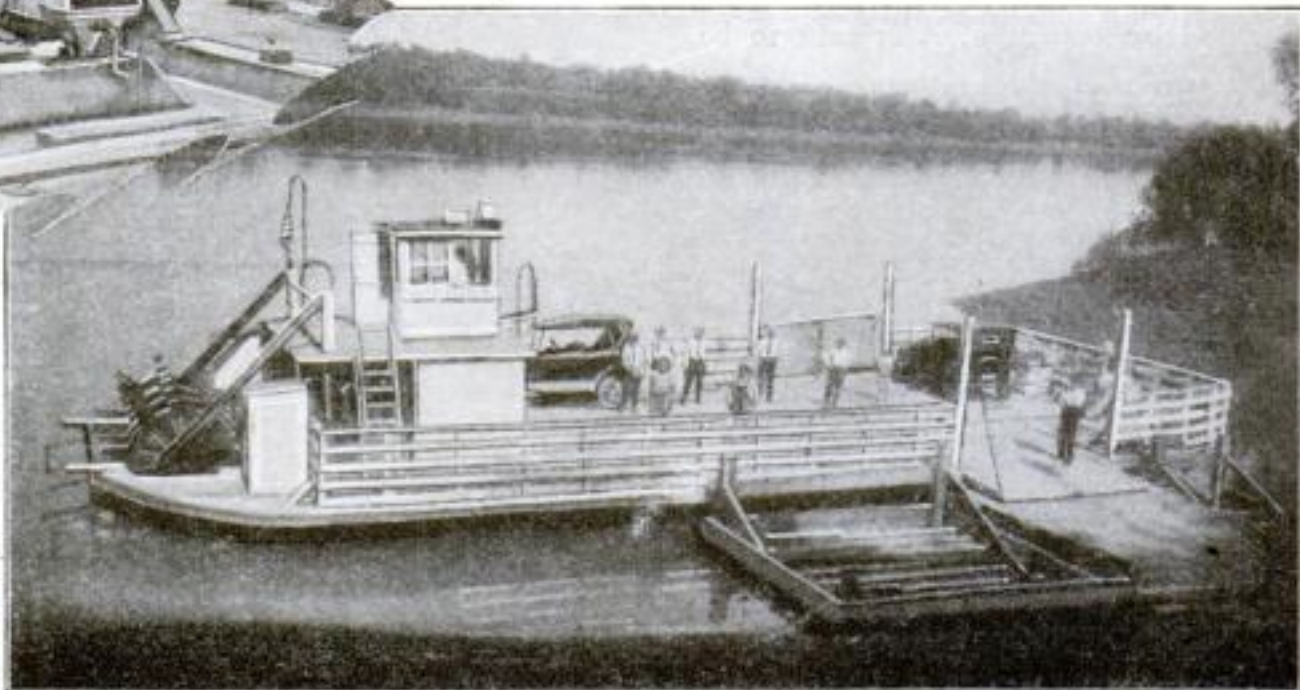
The tube will contain two decks, one for automobiles, the other for streetcars.

## Novel Test Shows Strength of Bridge Railing

**A**FTER an accident in which part of the concrete balustrade of a bridge at Springfield, Mass., was knocked down, engineers made unique tests to determine its exact strength. They used levers consisting of wooden planks inclined at an angle, butted against the base of the railing. Ropes tied to the planks were attached to the top of the railing by means of hooks.

Sand was poured into weight boxes on the ends of the planks. The amount in these boxes when the railing fell determined the weight necessary to overturn the railing. Although the railing fell inward instead of into the river in the tests, the results were taken as holding for either direction.

The tests served to establish standards of strength for future bridge construction.



The novel tractor-driven ferryboat docked at Paducah, Ky., on the Tennessee River





This photograph shows the spectacular illumination of Niagara Falls in 1907, which will be eclipsed by a more powerful system of searchlights

## Niagara to Be Illuminated

**T**HIS spectacularly beautiful effect, the illumination of Niagara Falls at night with searchlights, will be permanent after May 24. Twenty-four powerful searchlights, casting 1 1/3 billion candle-power, will be dedicated on that date, which is Queen Victoria's birthday.

Eighteen years ago the falls were lighted for 30 days, attracting thousands of spectators. The above photograph was taken at that time. In the new lighting of the falls, more powerful lights will be used, color screens and light drills sending beams that will be seen for 75 miles around.

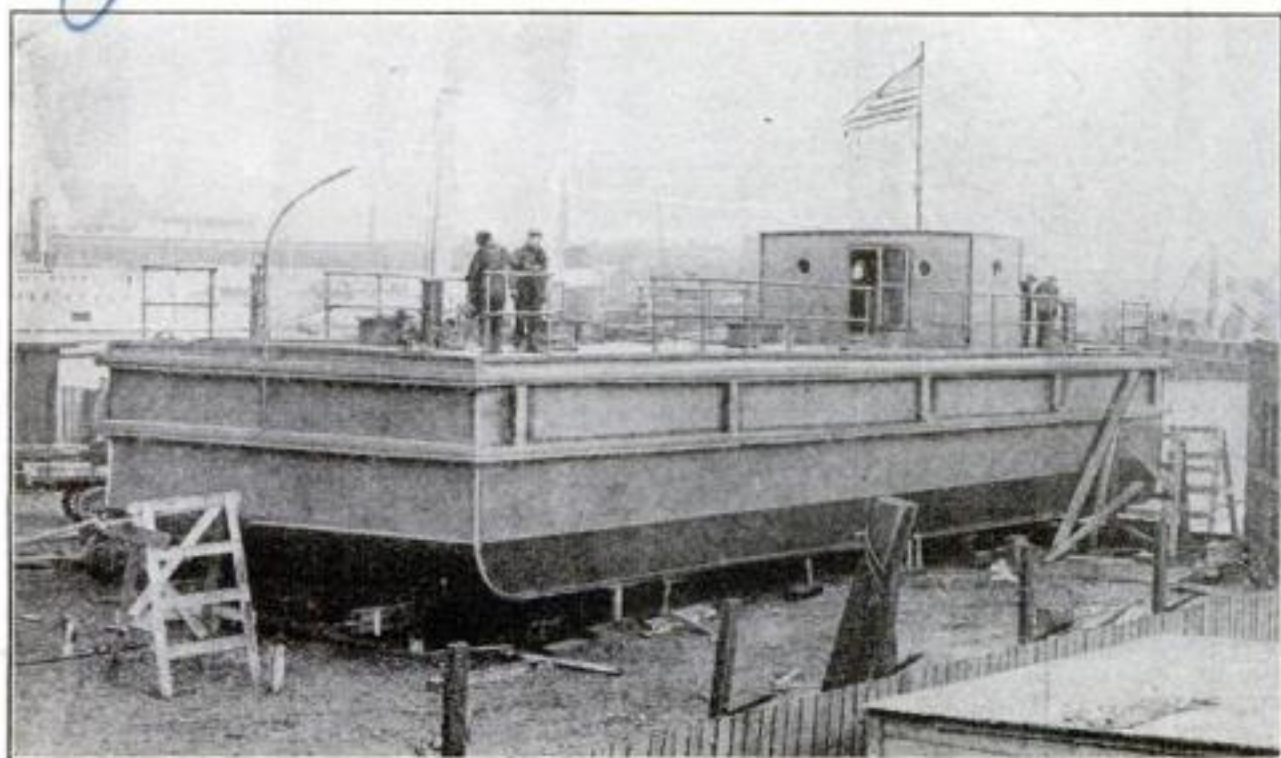
## A Ship without a Rivet

**A**N OIL-TANKER in one piece, without a rivet in its hull plates or a bolt in its steel frame, the first one ever built in the United States by the electric welding method, was launched recently in Providence, R. I.

Terrific heat generated by electricity fused together the sheets of steel and heavy angle iron in the tanker's frame.



Projected chain of natural waterways along the eastern coast from Boston to Mexico



The remarkable one-piece welded boat just before launching at Providence, R. I.

## U. S. Plans to Link Chain of Coastal Waterways

**B**Y LINKING a long chain of natural waterways with canals a continuous channel eventually will be available along the entire eastern coast of the United States, from Boston to the Mexican boundary on the Gulf of Mexico. By far the greater part of this route is now open for boats of limited draft. The entire route has been surveyed by U. S. Government engineers.

It is possible today to make the entire trip from Massachusetts to Florida with small craft without once going to sea.

The great system of canals that extends from New England to Florida is known collectively as the Atlantic Intercoastal Waterway. When the work now in progress is complete, it will afford a continuous channel 12 feet in depth as far south as Beaufort, N. C.



# Interesting Giants

## Do You Know of Any Better



### Sixty-Foot Loaf

This loaf of bread, said to be the largest ever baked in one piece, is 60 feet long and contains more than 400 pounds of flour. It was turned out recently in Minneapolis. Bakers here are seen removing the huge loaf from the oven



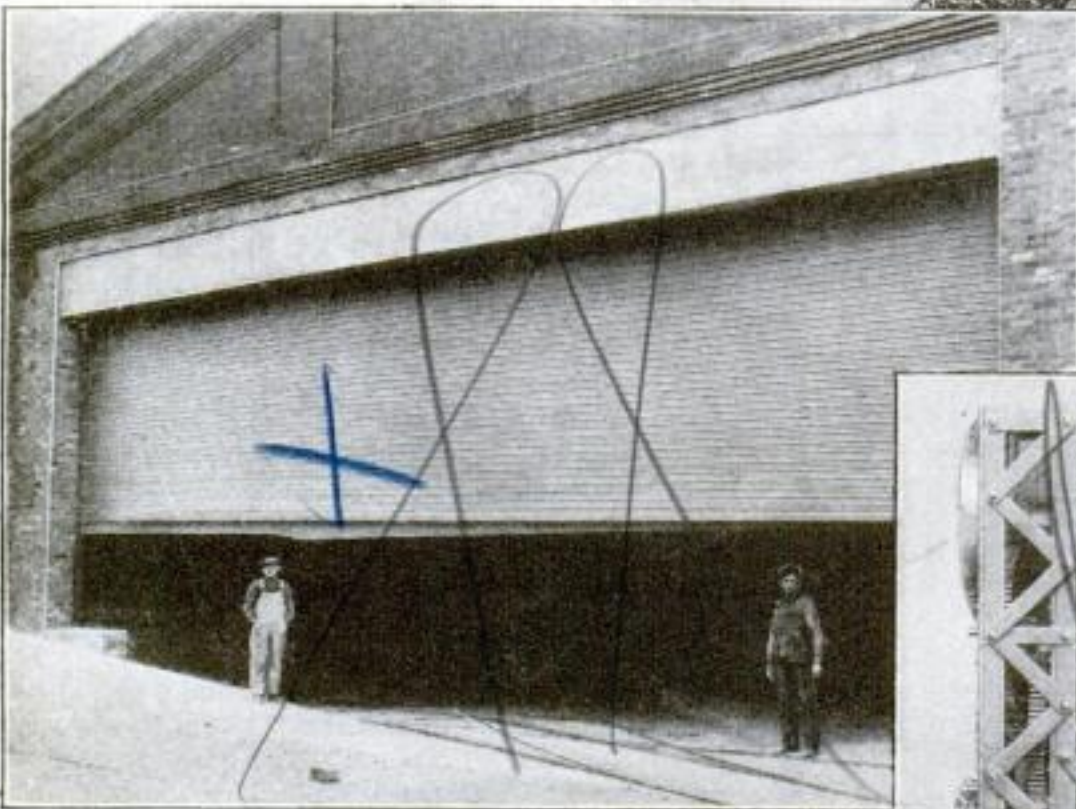
### The World's Smallest Fountain Pen

The midget fountain pen will hold a drop of ink and write 300 words, while the large one will hold 120 drops and write 36,000 words. They are shown side by side



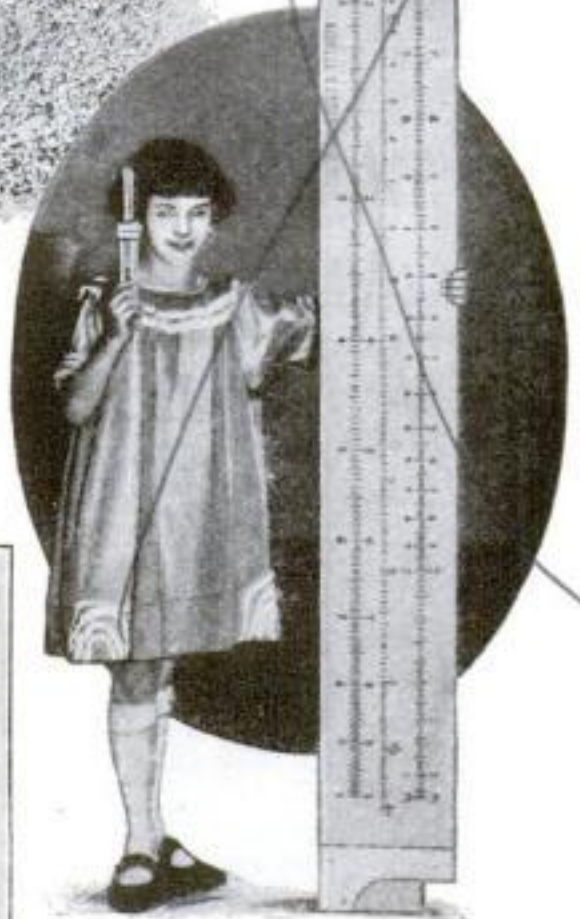
### Huge New Dam

In the Kentucky hills near the town of Burgin, engineers are constructing what is said to be the world's largest rock-filled dam. When completed it is expected to develop 36,000 horsepower, 13,000 more than the great Roosevelt Dam in Arizona



### Rolling Door Weighs Two Tons

This two-ton rolling steel door, said to be the largest made, was installed recently in a Brooklyn, N. Y., factory at a switching entrance 45 feet wide and 17 feet high. It is operated by an electric motor, which is shown at right



### Twenty-Foot Rule

The makers of this enormous slide rule say it is the world's largest. It is 20 feet long when extended, and 10 feet long when closed. Compare it with the ordinary foot-rule that is held in the child's right hand



# and Unusual Midgets

Claims to Records than These?



## Inch-High Electric Motor

The tiniest motor, made by H. McBroom of Houston, Tex., is less than an inch high and weighs only a quarter of an ounce



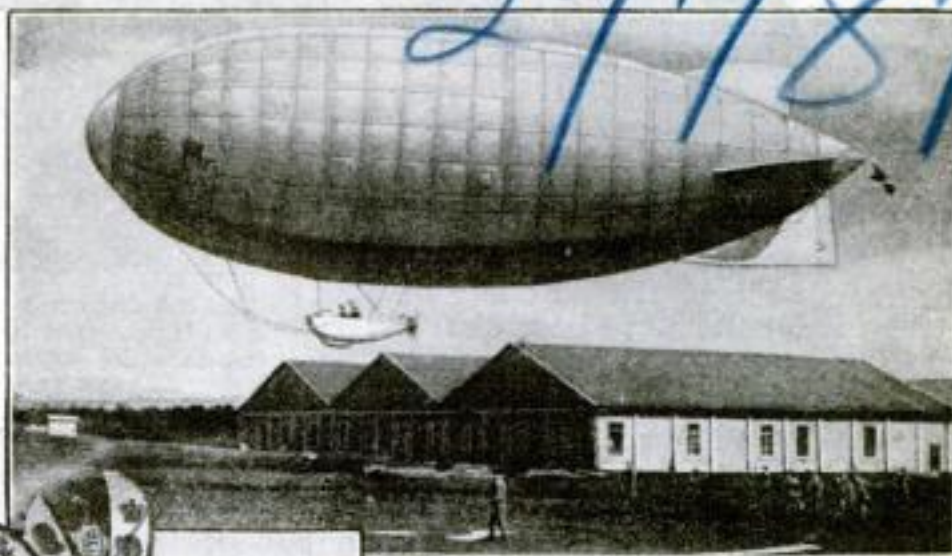
## The Largest Rock Ever Quarried

From the Stone Mountain Quarry at Atlanta, Ga., was taken recently what is believed to be the largest solid rock ever quarried. It is 40 feet high and contains 100,000 cubic feet of granite. Compare it with the man



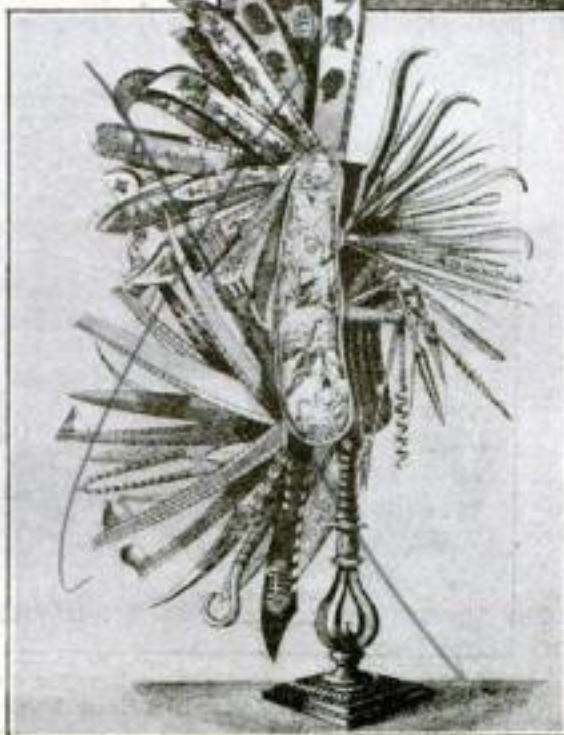
## Railway Giant

Two hundred and three tons of steel make up this giant locomotive recently designed by a Delaware & Hudson Railway engineer. It is said to develop one-third more power on one-third less fuel than any previous locomotive



## Midget among Airships

The world's smallest semi-rigid dirigible, the MR, was completed in Rome a few weeks ago from designs by Lieut. Col. Umberto Nobile. This little airship is only 105 feet long, as compared with the 663-foot length of the dirigible *Los Angeles*. It is designed to develop a speed of about 40 miles an hour



## A Knife with 75 Blades

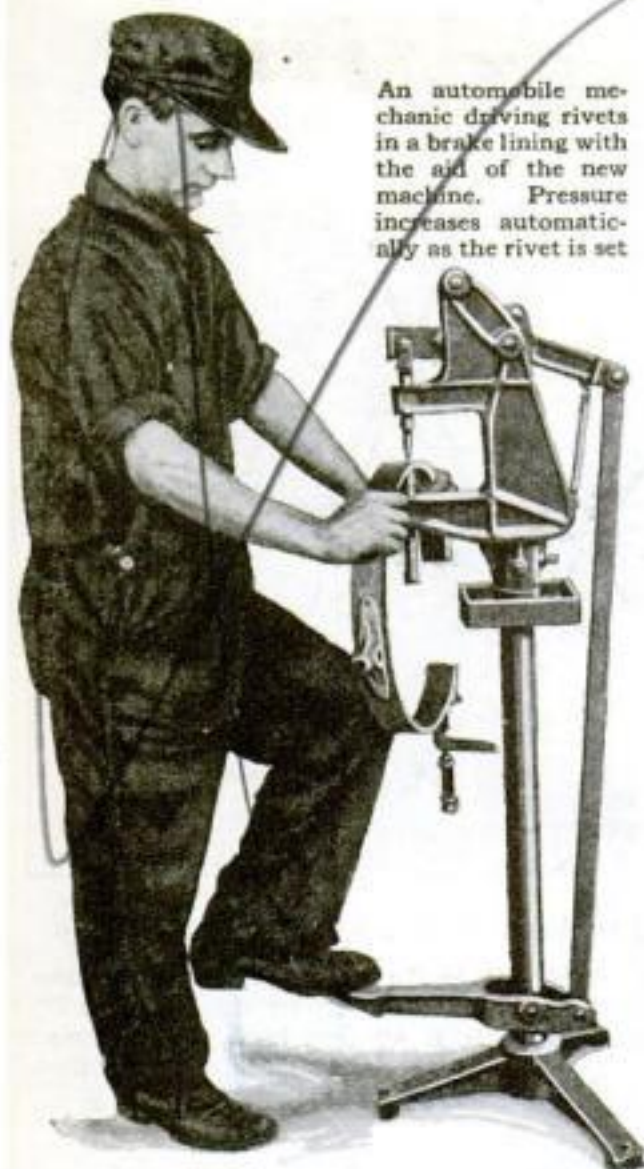
Some of the smallest blades ever made are contained in a marvelously carved knife produced by William Bamforth, member of a cutlery firm in Sheffield, England. The knife contains 75 blades, many of them ornamented with designs that are considered among the most perfect ever worked in steel



## A Book with 4000 Pages

Containing 4000 pages, this Chamber of Commerce registry book is said to be the bulkiest volume in the world. It weighs 340 pounds





An automobile mechanic driving rivets in a brake lining with the aid of the new machine. Pressure increases automatically as the rivet is set.

## Toolbox Forms a Convenient Step

A METAL box that slides under the runningboard, providing a convenient place to keep tools, is automatically locked so that its contents are safe from theft. An added feature, appealing especially to women, is an auxiliary step that comes into position when the toolbox is open, making it easier to get into the car.

When the door of the car is opened, a plunger in the door jam is released, so that the auxiliary step drops into place, at the same time making the toolbox accessible.

THE world spent \$3,360,000,000 for new motor vehicles in 1924, a survey by the U.S. Department of Commerce shows. On January 1 of this year there were in operation in all countries 18,615,000 passenger cars, 2,892,000 trucks and 1,262,000 motorcycles.



When the door of the car is opened, the front of the toolbox compartment automatically drops down to form the auxiliary step shown above. Left: The toolbox opened.

## New Riveting Machine Aids in Relining Brakes

IN RELINING brakes, rivets must be made absolutely tight, else the brake bands will soon break loose on account of chafing action on the rivets. A machine for driving rivets, recently put on the market, is said to do especially good work on account of its toggle action, which gives it increased leverage. It is operated by a pedal.

At the beginning of the riveting operation comparatively light pressure is exerted, the pressure increasing automatically as the rivet is set. Small or large brake bands can be riveted either from the top or bottom. Eight dies and punches are furnished with the machine.

## Bumper and Emergency Winch Combined

OFF the main highways, on bad country roads, the automobile driver often has to depend entirely upon his own efforts to get himself out of trouble. When stuck in mud or sand, the combination bumper and winch shown in the photograph at the right would prove a welcome aid. Attaching the line to a near-by tree or telephone pole, a man without other assistance could pull his car out on to firmer ground.

The winch is so geared that 100 pounds of power on the hand lever by which it is operated produces 5000 pounds on the line. Small springs prevent rattling in the bumper.

BY HEATING heavy and vegetable oils by electricity, a Russian inventor, M. Makhonine, recently perfected for the French army what he claims to be a cheap and efficient motor fuel.

## Compressed-Air Pistol Cleans Parts Quickly

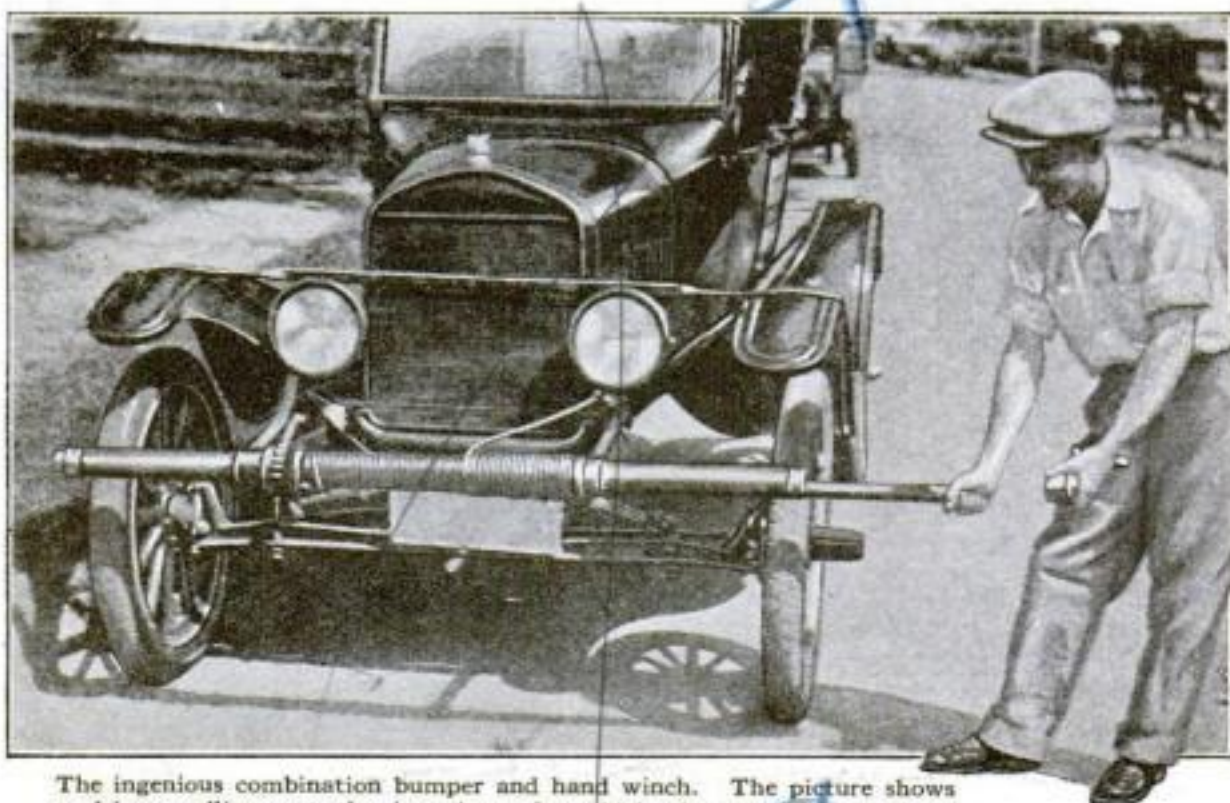


The cleaning spray of gasoline or kerosene is controlled by the pistol trigger, which is operated by compressed air.

OPERATED by means of compressed air, this spraying gun is designed particularly for cleaning automobile engines, transmissions and gears. Either gasoline or kerosene may be used. The spray is controlled by a trigger, and the gun is gripped and held like a pistol.

The device may be used, also, for applying wood preservatives, insecticides, creosote, thin paint, or whitewash.

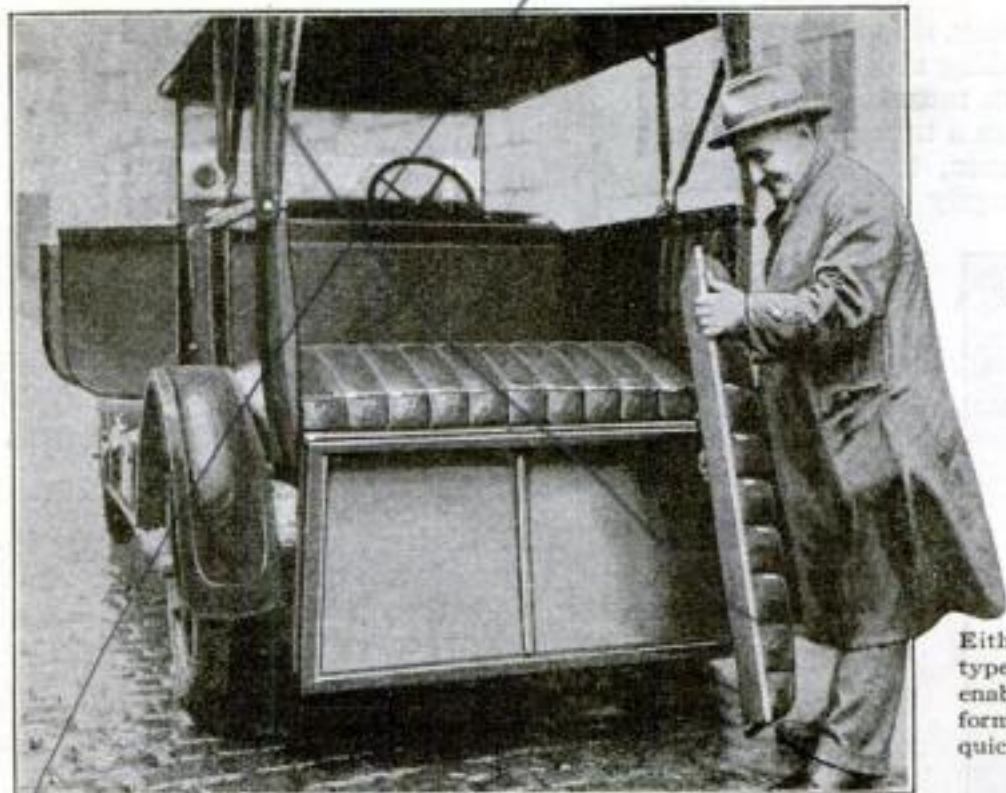
THE streets of Paris, France, now are swarming with miniature one-passenger taxis, compact and light, and exceedingly economical in tires, gasoline consumption, and cost of manufacture. They have a wheel track of only 46 inches.



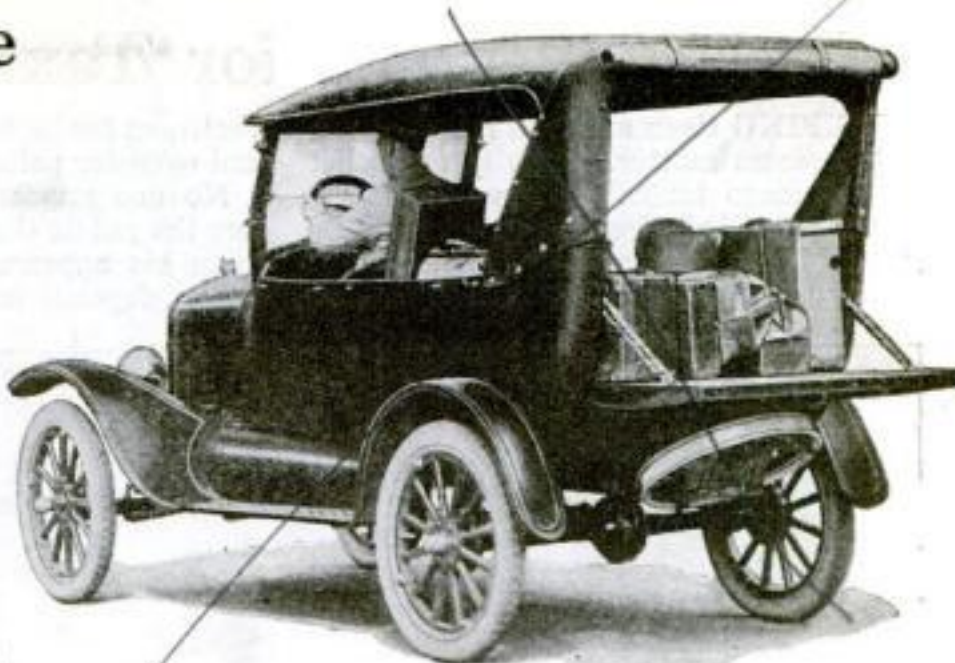
The ingenious combination bumper and hand winch. The picture shows a driver pulling out the iron lever by which the powerful winch is operated. The line can be attached to a near-by tree or a telephone pole.



## Cars for Business or Pleasure



Either one of these two types of convertible bodies enables the owner to transform his pleasure car quickly into a small truck

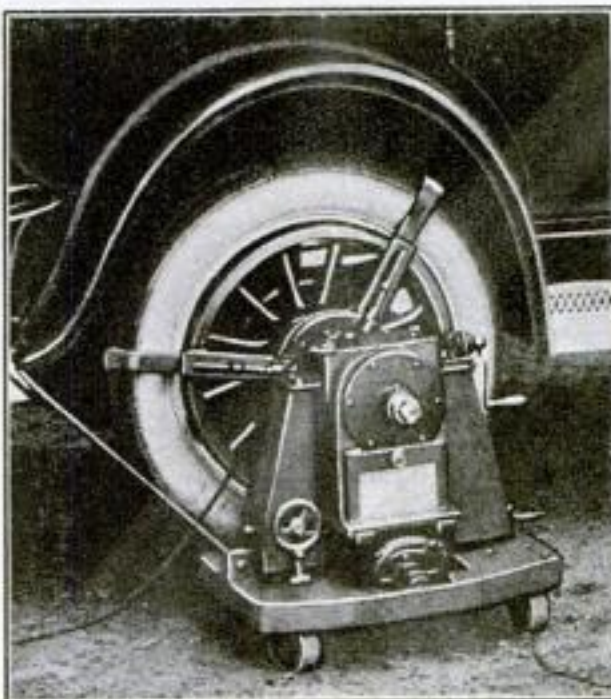


### This Auto Can Be Turned into a Delivery Truck

A QUICK change from a comfortable and roomy pleasure car to a small delivery truck has been made possible by a newly devised automobile body with convertible seats.

When it is to be used for pleasure, the car is provided with upholstered rear seats. When it is to be converted into a delivery truck, these seats are taken down and reversed to form a smooth, even floor. The rear of the body is on hinges and swings downward to provide access to the truck from the rear.

THE state of Massachusetts recently began consideration of a plan to utilize the roadbeds of abandoned railways as possible highways for motor-truck transportation routes.



Driven by an electric motor, this testing machine turns the wheel against the brake.

### Convertible Body Useful for the Farmer

ANOTHER new type of convertible body for Ford cars is especially designed for farmers and merchants who use their machines for both pleasure and business. This body is so designed that the rear seats fold forward into the floor and out of the way. A tail gate can be lowered from the rear.

When the tail gate is closed, there is nothing to distinguish the machine from other pleasure cars of the same make.

The manufacturers claim that it can be converted from pleasure to business car in less than a minute.

### Auto Brakes Now Tested by Machinery

TOO often the adjustment of automobile brakes has been done by approximation and guessing. By means of an ingenious dynamic brake tester recently invented, one can tell exactly how many pounds of pressure there is on a brake drum while the wheel is in motion, and make adjustments accurately.

Only one man is required to make the test with this machine. After jacking the car off the floor, he sets the brake pedal with a special depresser that holds the foot or service brake under a constant pressure. The brake tester, driven by a motor, is then clamped firmly to the automobile wheel.

An electric motor turns the wheel against resistance of the brake, and an indicator on the machine records the number of pounds pressure at all points on the brake drum. Adjustments can be made while the brake tester is on the wheel.

In case of four-wheel brakes, the front wheels usually are given two-thirds of the pressure applied to the rear wheels.

### Plan Revolving Garage

A POSSIBLE solution of the shortage of parking and garage accommodations is offered in a revolving garage to be erected soon in the West End of London, England.

The floors of the garage will be arranged as concentric rings, each of which will be divided into a number of one-car compartments. The floor will be revolved so that any compartment can be brought into line with the main entrance.

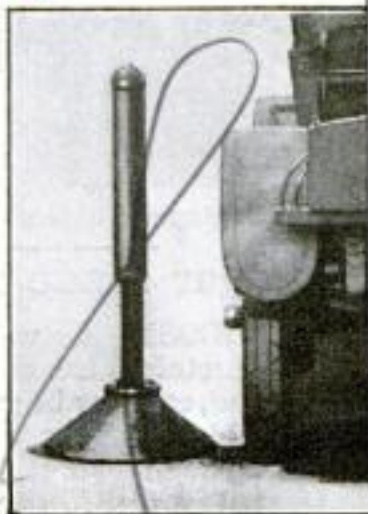
### Flexible Traffic Post Takes Hard Knocks

SCIENCE and man's inventive genius are continually trying to care for the careless motorist. One of the resultant products is a portable flexible "iron man" as a traffic guide for street crossings. The invention is designed especially for suburban and rural districts where stationary concrete or metal traffic posts very often are a menace, especially at night-time.

When a car strikes this signal post, no damage is done, for the upright shaft is mounted on a heavy but flexible spring. This allows the signal to bend down out of the way so that the car may pass over it harmlessly. The upper half is made of tube steel and is half an inch larger than the supporting spring.

When a careless motorist rubs or knocks against the signal, the tube striking against

the spring rings so that it may be heard two blocks away. Red lights may be attached to the post. Snow, ice, and inclement weather are said not to affect the operation of the new signal device.



This new portable traffic post is mounted on a flexible spring so that if struck by a car, it will bend, as shown above, preventing damage to both the car and the post



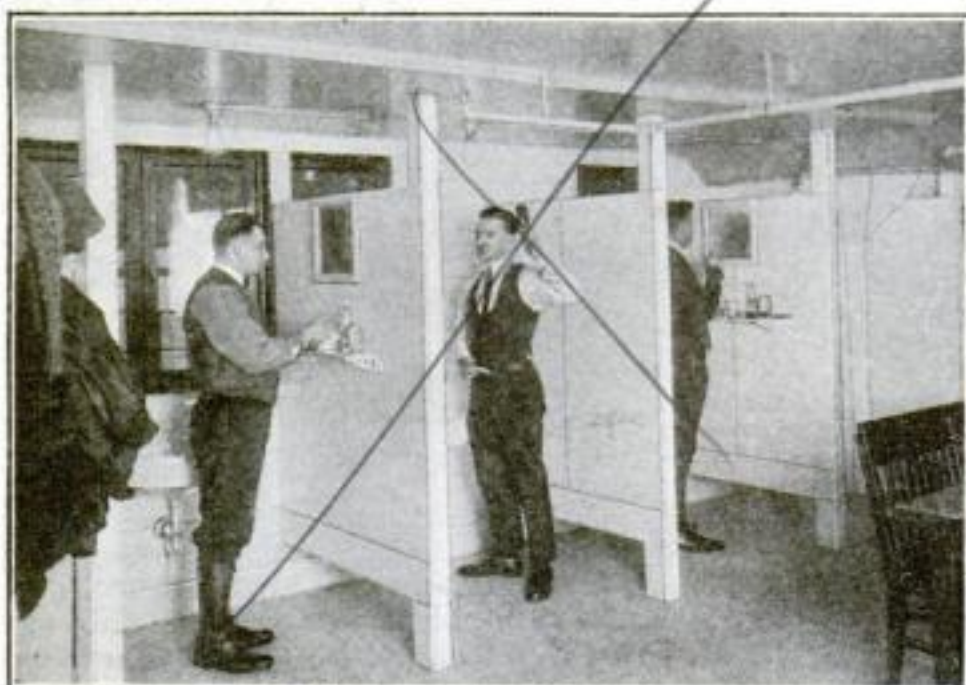
## Dressing-Rooms for Taxi Drivers

**K**EEPING clean and well groomed is a business matter. This is the belief of a Chicago taxicab company that recently installed dressing-rooms for its drivers in several garages. These rooms are equipped with the most modern con-

veniences for bathing, shaving, grooming, and even for polishing shoes.

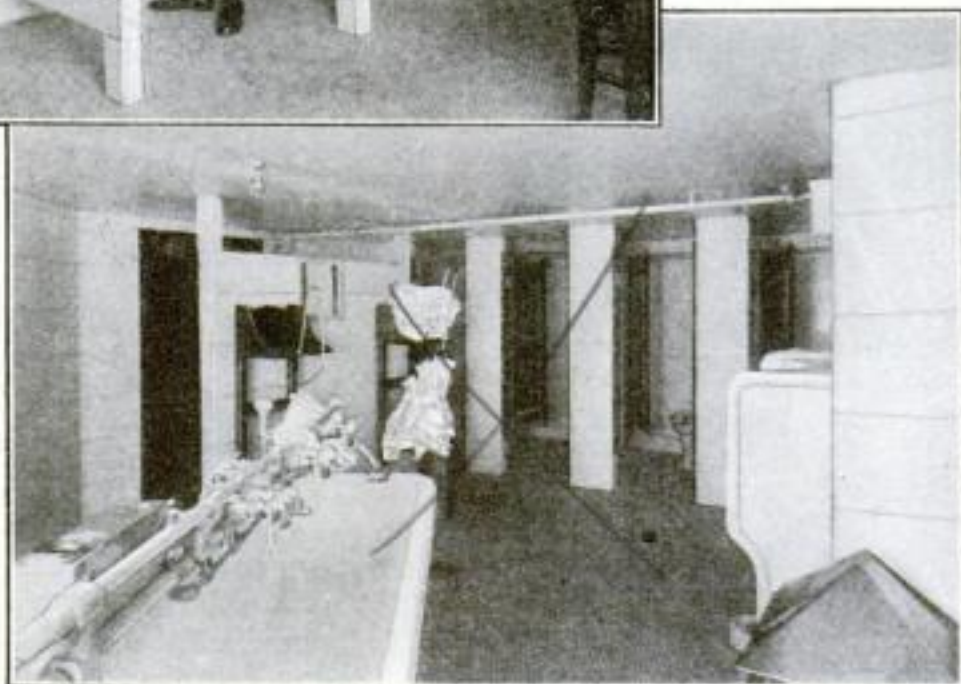
No one appears more constantly before the public than a taxicab driver, and upon his appearance, the company believes, depends largely the public's attitude toward his employers. With a good appearance comes a bearing of self respect.

A FRENCH inventor, De Grammont de Guiche, has perfected a method that enables an airplane pilot to tell by sound his exact flying speed.



### It Pays Them to Look Fit

Each taxi driver is provided with an individual dressing room, fitted with porcelain washbasin, shaving mirror, and toilet accessories, as shown above. Here he keeps himself well groomed for the day's job. In addition, the most modern bath and toilet facilities are at his service.



## Heavy Moving Simplified by Low-Slung Van

**T**HE heavy job of lifting large packing cases and articles of furniture in loading or unloading a motor-van has been made much easier and simpler, it is claimed, by the recent development of a new type of truck with extremely low chassis and body.

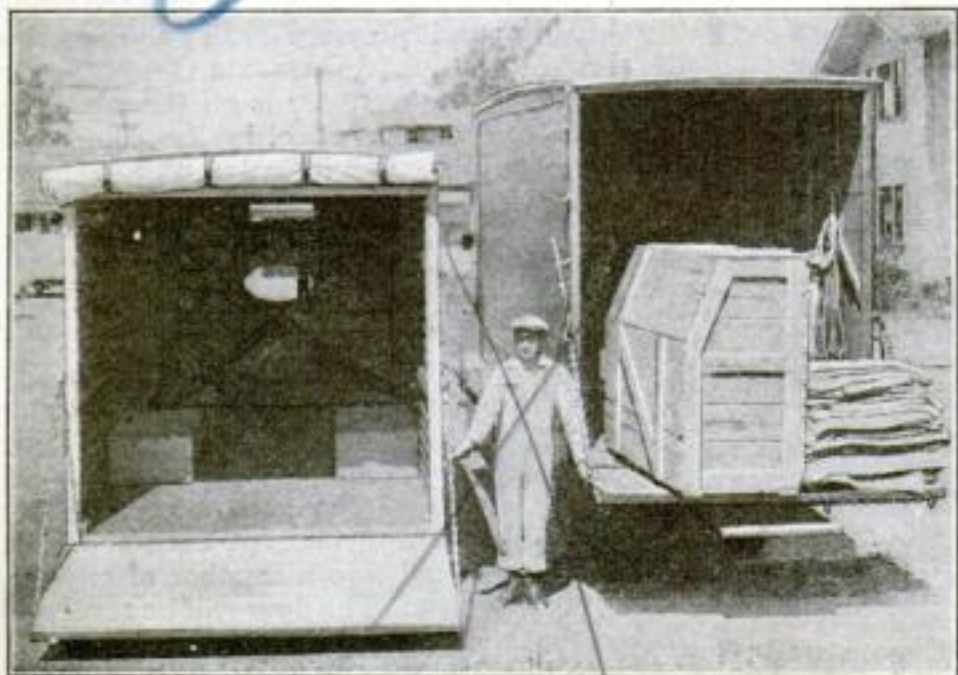
The floor of the moving-truck is hardly above the knees of the average sized man, thus greatly reducing the lifting distance

for the furniture remover or the expressman.

The low center of gravity also is said to assure greater safety in turning corners with a heavy load, and better riding qualities over rough roads.

The new design, known as the low drop-frame chassis type, is the invention of a California truck manufacturer. A striking comparison with the ordinary type of motor-van is shown in the accompanying illustration.

BY CAUSING successive waves of sound to interfere with each other's transmission, Dr. G. W. Stewart, a professor of physics at the University of Iowa, has perfected a device that he believes in time may be used to eliminate undesirable noises and to adjust sounds to suit the taste and the nerves of any individual.



The new low-frame motor-van (left) compared with an ordinary van



### Simple Wire Brush Keeps Carpet-Sweepers Clean

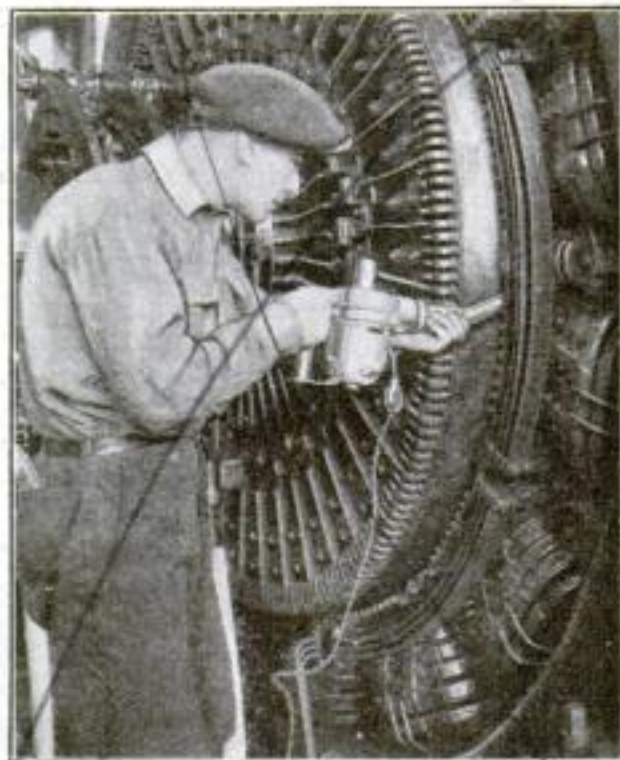
**S**TRONG bent wires in this newly invented brush quickly remove tangled hair and thread from the brushes of carpet-sweepers or from vacuum cleaners. Thus a common annoyance to the housewife has been removed by a simple but effective invention.

### Electrical Blower Cleans Dust from Machinery

**O**PERATING either as a suction cleaner or blower, an ingenious new electrical aid for the mechanic removes coal dust, dirt, and other accumulations from machinery. A hose attachment enables the operator to get at all parts of a large machine or switchboard and eliminate all dust.

The cleaner can be attached to any light socket. In the photograph the device is shown being used as a blower. When used as a suction cleaner, a dust bag is attached. The apparatus can be slung over the shoulder of the operator with a strap, leaving both his hands free for work.

When operated as a blower, the air leaves the nozzle at a velocity of 200 feet a second—nearly 140 miles an hour.

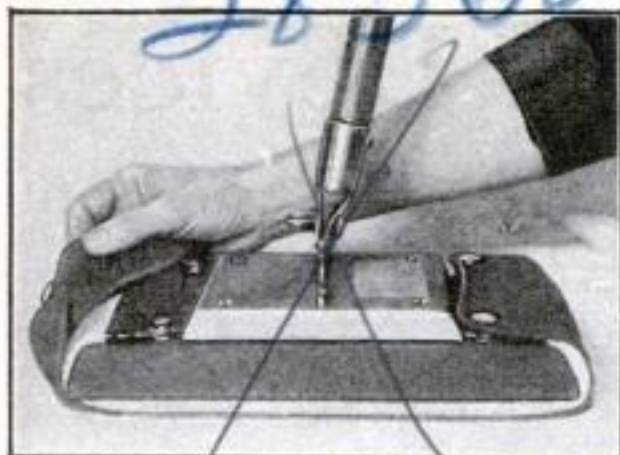


Cleaning machinery with electric blower

### Sugar Made from Weeds

**L**EVULOSE, a valuable sugar that heretofore has cost from \$30 to \$110 a pound, can now be made cheaply enough for table use by a process perfected by the U. S. Bureau of Standards. It is extracted from dahlias and from Jerusalem artichoke, a common weed.





### This New Floor-Waxer Has Removable Pads

**B**OTH the waxing and polishing pads of a new floor-waxer, which weighs only a few pounds, are removable for washing.

After the wax is spread on the floor with the outside pad, it is unbuttoned and the floor polished with the dry pad underneath.

### New Belt-Lacing Machine Saves Time and Labor

**F**OR lacing broken belts quickly, leaving smooth and strong joints, a compact machine has been designed to save the time required by hand work. Belts not over three-eighths inch thick may be laced in a few minutes without removal from the shaft. The tool is designed not only for machine shops and factories in mending heavy belts, but for garages in repairing fan belts. With this tool a garage need keep on hand only a few rolls of belting in popular widths to make up fan belts as required.

No two hook points enter the belt directly opposite each other, so that no belt fibers are broken. The machine embeds the hooks even with the belting surface.



Mending a heavy machine belt

### Detects Artificial Pearls

**A** SIMPLE new method of distinguishing the Japanese artificial pearl from natural pearls has been discovered by Prof. Daniel Bertholet, a French scientist. He plunges the pearl into cedar oil brilliantly illuminated with converging lights and examines it through a submersible lens.

## Canoe-Sailboat Is Collapsible

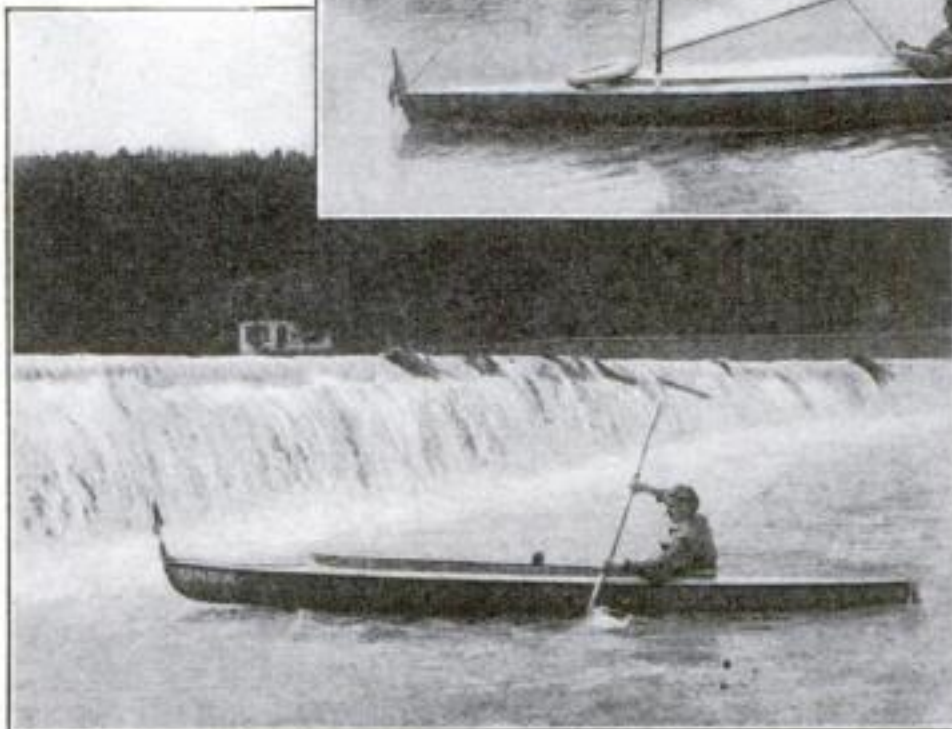
**A** NEW design of collapsible canoe that can be converted into a sailboat, is of particular interest to hunters and fishermen. Because of its extreme lightness it can be used on all waters with safety, it is claimed, even in shallow streams.

The thrilling sport of shooting rapids loses much of its danger with this canoe.

Over a simple frame of pliable staves, readily assembled, is stretched a specially designed cover in one piece. This is waterproof, consisting of canvas with an intermediate layer of rubber. Another cover

protects the cockpit from rain and splashes of water.

Rigging can be added to the canoe without damage to the structure. The canoe will carry three persons comfortably, it is said, while allowing plenty of room in which to stow away luggage. The frame can be packed in one or two bags.



#### A Craft for Sportsmen

Although extremely light and of shallow draft, the canoe will carry a small leg-o'-mutton sail as shown above. Its seaworthiness is demonstrated in the picture at the left, where it is seen riding easily just beyond the falls.

## Hand Levers Drive Odd Oarless Lifeboat

**R**OWING a boat without oars is the surprising achievement made possible by a British inventor, who recently designed an unusual new type of lifeboat propelled by hand levers. The purpose of the invention was the creation of a craft that could be sent away from the side of a disabled ship without the delay of adjusting oars in their locks.

In place of oars, levers are provided in front of each seat in the boat. There are eight levers in all—four on each side of the craft. They are geared to a propeller shaft so that as the oarsmen pull them back and forth they drive a screw at the stern, sending the boat through the water.

Since, contrary to the old way of rowing, no especial skill is required to operate the levers, the boat requires

only one trained seaman to handle the tiller.

The invention was demonstrated recently at the King George Dock, London.

BECAUSE of temperature expansion and contraction, the Washington Monument is about 5½ inches higher in summer than in winter.



Demonstrating the new lever-propelled lifeboat at King George Dock, London. Geared to the propeller shaft, the levers drive the screw

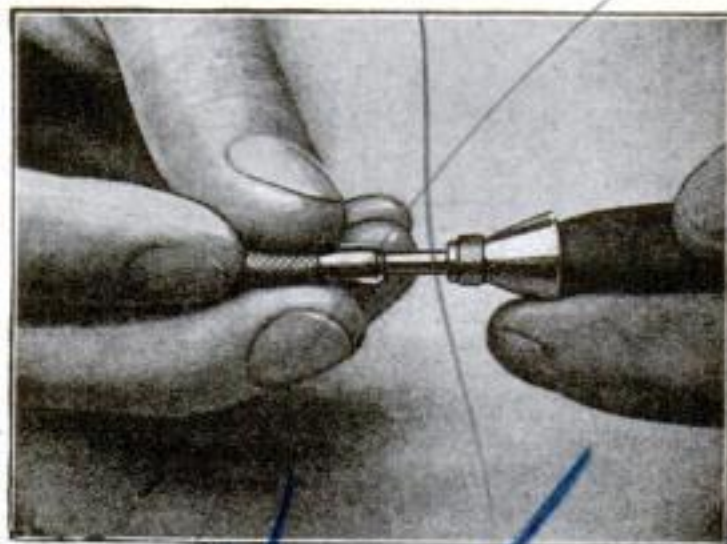


# Ingenious New Devices

## Fourteen Handy Products from

### Self-Soaping Brush

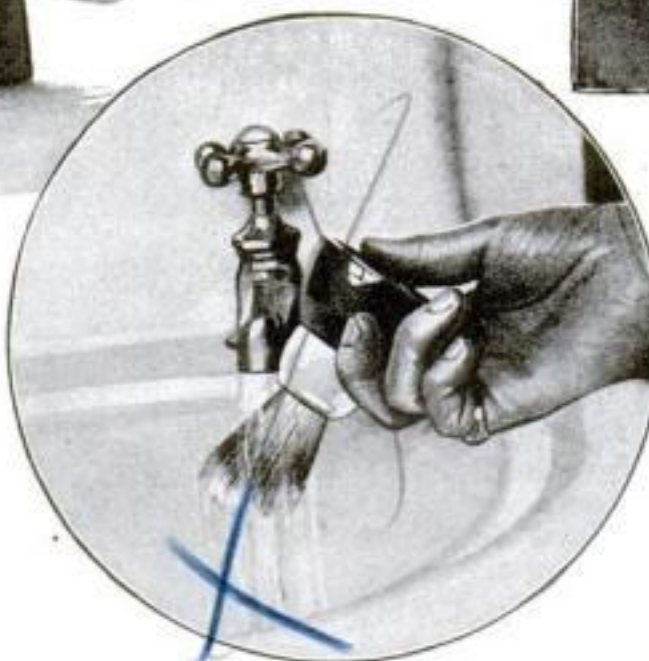
A TWO months' supply of shaving cream is contained in the handle of a new type of shaving brush (below) designed especially for the traveling man. Pressing the handle forces just enough cream for a shave into the bristles of the brush.



### A Pocket Cigar Piercer

OCCASIONALLY the smoker encounters a cigar that requires considerable coaxing with a pin or other sharp instrument before it will draw satisfactorily. It is because even the best cigars are not always perfect in this respect that the pocket cigar piercer pictured above has been invented recently.

The device consists of a thimble-shaped metal socket into which the end of the cigar is held. Entering the socket is a small drill that is twisted with the fingers.



### Stencil Makes Bow Lips

PERFECT Cupid's-bow lips can be made in a few seconds, even by persons who are inexpert at make-up, it is claimed, with the aid of a newly devised beauty stencil.

The flexible stencil is held firmly over the mouth so that the opening fits the outline of the lips. Rouge or a lipstick then is applied, producing the Cupid's-bow effect.



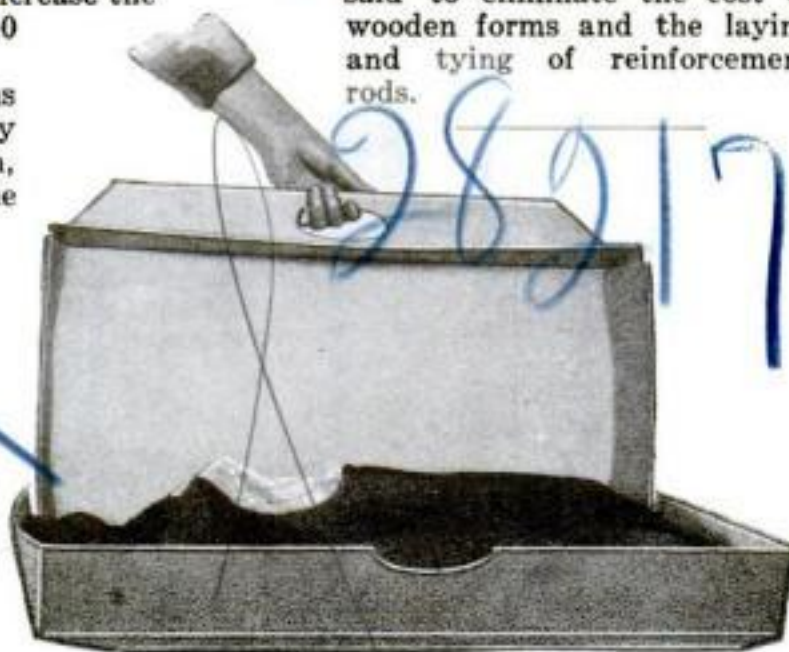
### Wooden Fins for Swimmers

BATHING shoes fitted with hinged wooden fins are the latest aids for the swimmer devised by a Dutch inventor. He claims that the shoes will increase the speed of a swimmer at least 10 times.

When pulled forward, the fins close, and when forced out by the stroke of the feet, they open, pushing powerfully against the water.

### Handy Suit Box

A NEW type of paste-board suit box is made in one piece, with a handle for the lid cut in the board. The box opens like a suitcase and requires no twine to hold it together. Each end of the box is reinforced by a double piece.



### Floor Slabs of Concrete

A SAVING of 30 per cent in building costs is said to be made possible by a new method of reinforced concrete construction. In this process small factory-made slabs of reinforced concrete are used instead of the present method of pouring concrete in large slabs. Floors, walls, and partitions made of the small units, the inventor claims, will stand strains that reinforced concrete in one piece will not, and air spaces are provided in which wires and pipes may be laid. These further serve to make walls or partitions soundproof.

A. G. Tabatchnik, a Russian architect, is the inventor of this method, which is said to eliminate the cost of wooden forms and the laying and tying of reinforcement rods.



### All-Sport Hand Racket

FOR any of the many kinds of ball games that boys and girls play in the street or against brick walls, this light hand racket recently has been perfected. The frame and strings are made of gut, with a thin wood backing. The hand fits into an adjustable back strap.



# for Pleasure and Comfort

## the Workshops of Inventors



### Reflector Serves as Stove

A JOINT in the stem of this ingenious gas reflector permits it to be turned into a simple burner upon which one may cook the morning coffee. When upright the device serves as an ordinary heater.

### Ferns Water Themselves

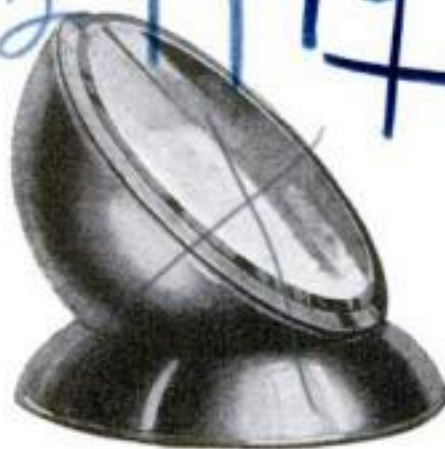
FERNS water themselves if provided with the apparatus recently devised. The soil absorbs water from a porous porcelain cone that drains water from a reservoir bottle fitted with a siphon.



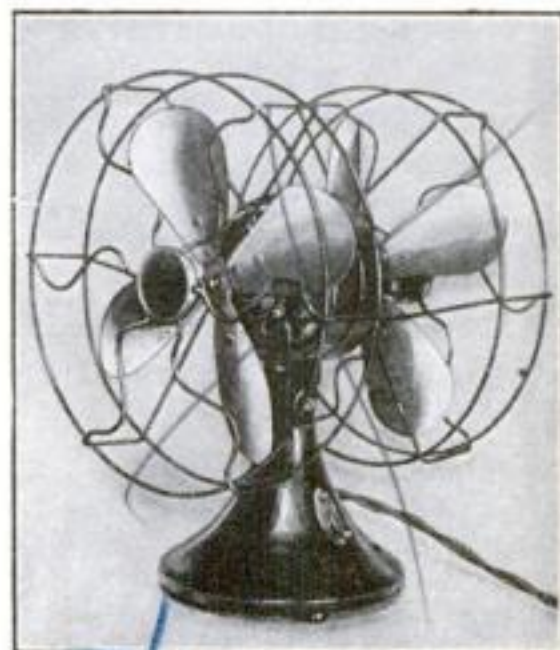
### Adjustable Safety Razor

THE latest type of safety razor may be adjusted to any desired angle. The shaver may use it in the regular safety style with the blade at right angles to the handle, or at another angle, giving a diagonal stroke.

### New Full-Length Mirror

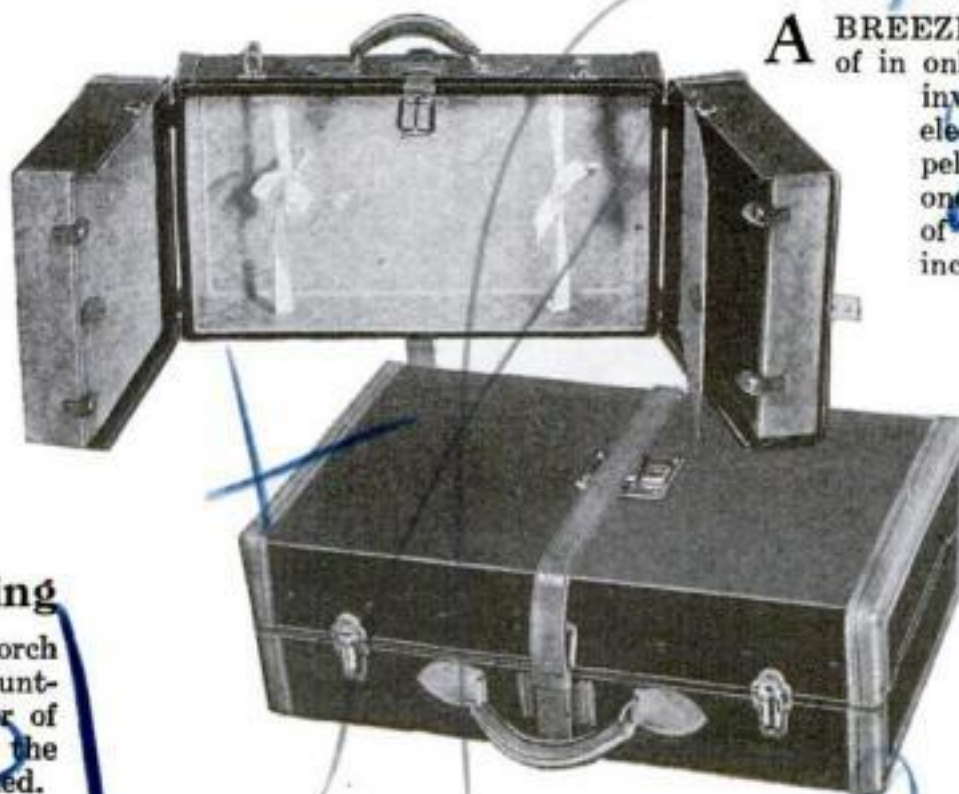


THIS portable floor mirror invented by a Frenchman, shows the hem of a skirt, the grace of a neck line, or the entire gown, thus serving the purpose of a full-length mirror. It is easily adjusted to position.



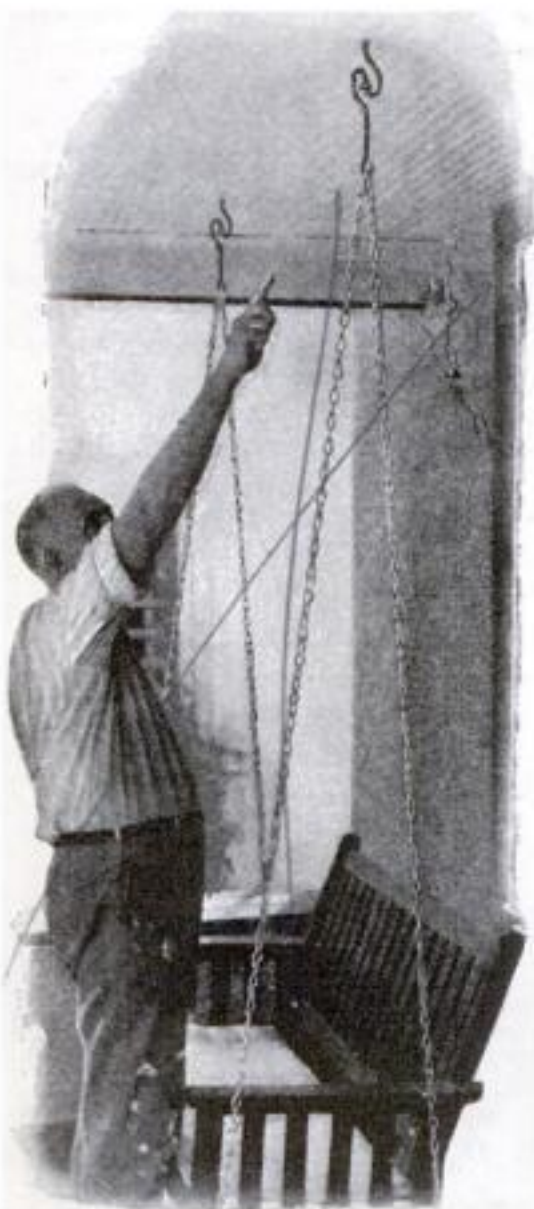
### Two-in-One Fans

A BREEZE in all directions instead of in only one, was the aim of the inventor of this two-in-one electric fan. It has two propellers on the same spindle, one on each side. The quantity of air distributed is said to be increased.



### New Suitcase

POPULARITY of the wardrobe trunk led to the manufacture of a new suitcase that has a compartment for hats as well as for shoes and soiled clothing. In one half is ample space for suits or dresses, while the other half is divided into the two sections.



### A Squeakless Porch Swing

TO ELIMINATE squeaks in porch swings, Joseph E. Morse, of Huntington, Ind., has invented a hanger of ball-and-socket joints suspending the hooks to which the chains are attached.



## Home Chlorine Treatment for Colds

FOR treating colds at home with chlorine gas, a gas-generating inhaler recently has been devised. This is used with a special compound containing chlorine, which is given off when the substance is heated.

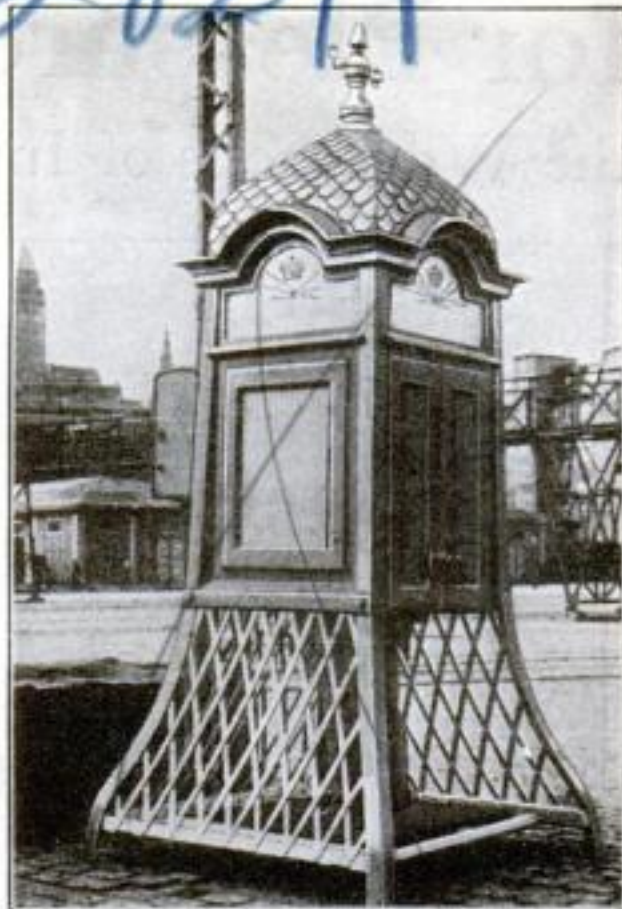
The strength of the gas is said to be easily regulated by the patient and a single treatment to cost about a cent and a half.

### Perfect Noiseless Plane

BRITISH aviation experts are reported to have virtually eliminated the deafening roar of airplanes in flight. By a new invention it is said that exhaust gases are permitted to escape noiselessly without lessening power or speed. A noiseless propeller also has been devised by an ingenious arrangement of gears.



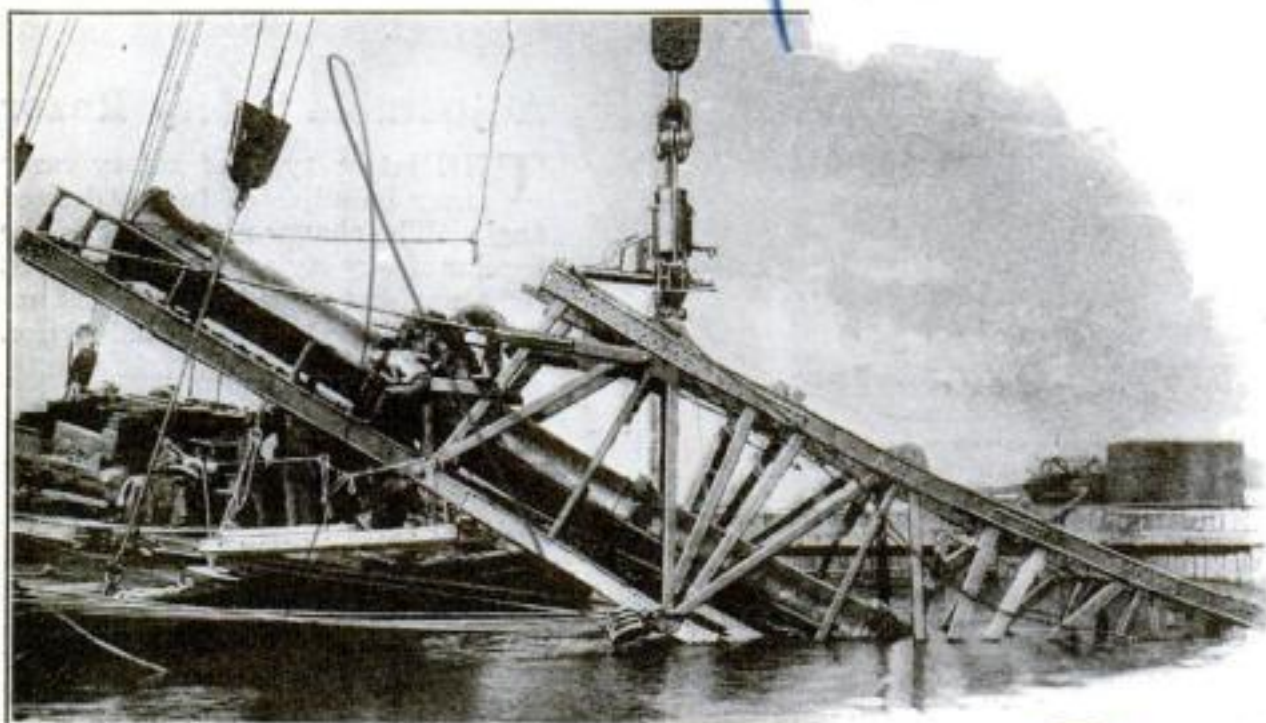
How the new chlorine inhaler is used for the treatment of colds at home. A special chlorine compound is used



### Swedish City Has Fresh-Air Telephone Booths

EVERY one who has been cramped in poorly ventilated drug-store telephone booths, can appreciate the cleverness of the Swedish inventor who thought of putting public telephones in boxes out of doors, on convenient street corners.

The booth illustrated above is of the latest design, erected recently by municipal authorities in a large city in Sweden. Open lattice-work admits fresh air.



### Cradle Lays Pipe Line across Straits

TO SAVE time in laying a pipe line from Hetch-Hetchy, the water supply source for San Francisco, Calif., across the Dumbarton Straits of San Francisco Bay, engineers recently devised and employed the huge tilting cradle pictured above. So quickly and accurately does this mechanism place the pipe in position, that the engineers planned to complete the job in 60 days.

The photograph shows one section of the pipe being lowered.



George Taylor of the U. S. Department of Agriculture, holding the finest wire

### World's Finest Wire Is Too Small for Eyes to See

THE finest wire ever made, wire so slender that it cannot be seen with the naked eye, was manufactured recently by George Taylor, a physicist in the United States Department of Agriculture. In the photograph at the left he is seen at work in his laboratory.

Wire of this kind is not only a novelty, but a practical commodity. Among those who use extremely fine wire are surgeons and dentists.

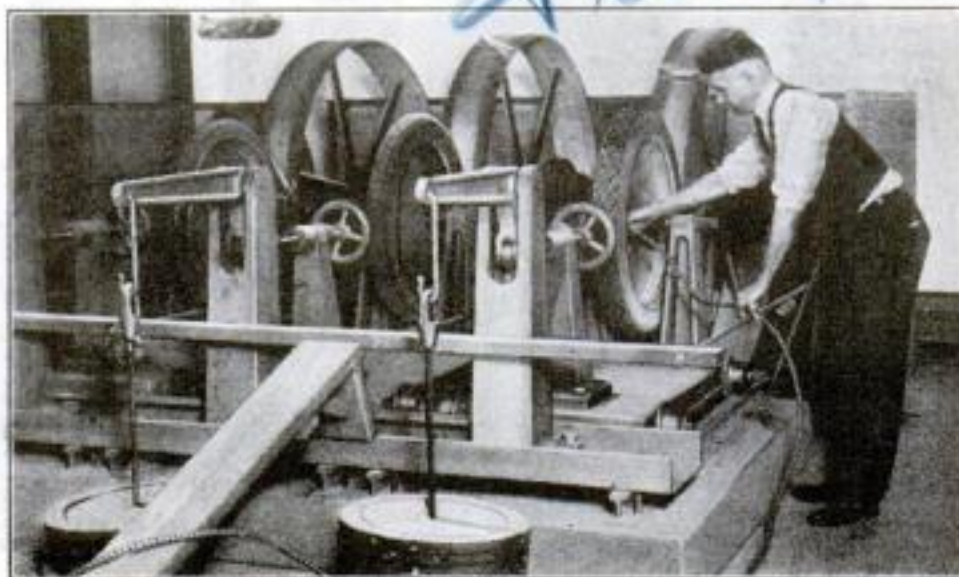
AN EXTENSIVE business in disinfecting public telephone apparatus once a month with a new preparation called "neroforn" recently has been developed.

### Machine Predicts Tire Life

HOW long will your new tire last? It is to the manufacturer's interest to know the answer to that question before the tire leaves the factory. A machine for testing the durability of automobile tires, making accurate predictions of the service they will give, has been devised recently by experts of the U. S. Bureau of Standards at Washington, D. C.

A tire is run under standard conditions against the rim of a wheel provided with bumps. After a certain time the tire is examined for signs of failure. Weak points in the tires show up in a very short time, often in as little as two days. In actual service such a tire might last from six months to a year.

Tests are made also to determine whether the chemical and physical properties of the materials are those required by the specifications and found to be necessary for the construction of durable tires.



Measuring the durability of an auto tire with the testing machine

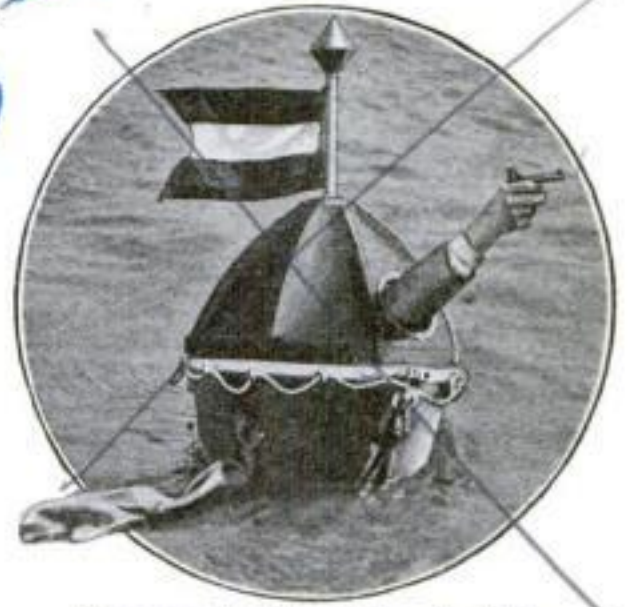


## Unique Lifebuoy Rides Heavy Seas

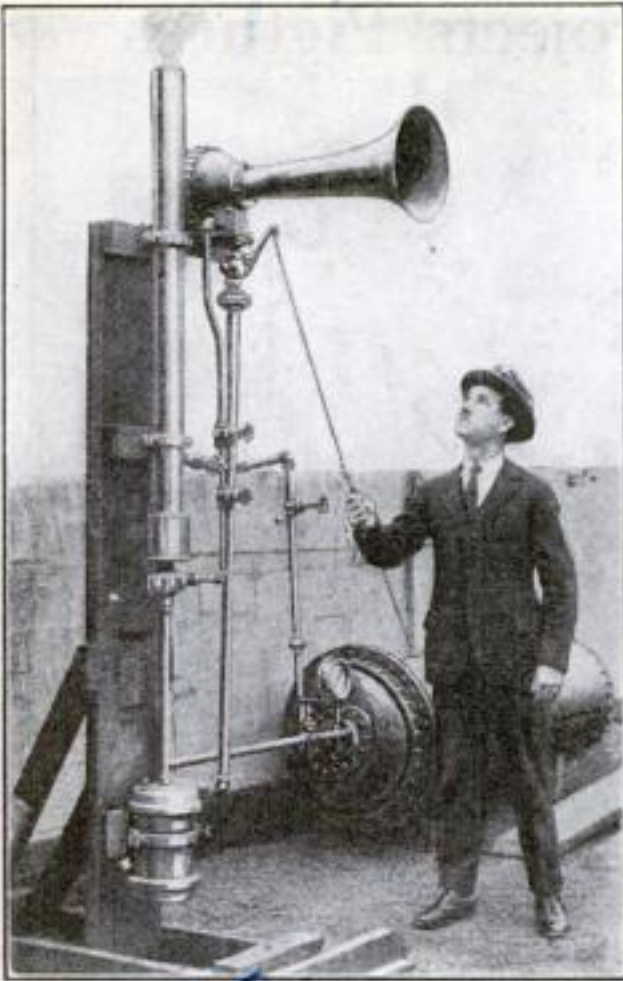
IN AN ingenious new life-saving buoy, recently tested successfully in the North Sea, the victim of a shipwreck can survive in safety and in comparative comfort as long as his provisions last, the inventor claims.

The buoy with its passenger rides easily over the waves, even in severe storm, it is said. A porthole in the upper part of the device can be opened and closed. It is just large enough for the occupant to thrust his arm through and fire a pistol to attract attention, as shown in the photograph.

THE next eruption of the volcano Etna may be heard by radio throughout Europe and possibly in America. Signor Marconi is establishing a new radio station on the rim of its crater and purposes to broadcast its mutterings.



The occupant of the lifebuoy is able to thrust his arm through the porthole to fire a distress signal if help is near



### Motor-Ship Whistle Made to "Smoke" without Steam

THE advent of the motor-ship, using Diesel oil-burning engines instead of steam, presented a real problem in the matter of adequate whistles. For the usual puff of steam that told the pilots of other ships where the whistle came from was lacking. Compressed air employed to operate the whistle produced plenty of noise, but no visible signal.

The problem was solved recently when a motor-ship engineer conceived the idea of using a tank of liquid smoke, like that used in airplane sky-writing, in conjunction with the compressed air. This smoke pours forth every time the whistle is blown.

The ingenious new invention is pictured above.

### Illuminated Sign-Posts to Aid Tourists

ILLUMINATED sign-posts to direct motorists on unfamiliar roads at night as well as in the daytime were exhibited recently at a national convention of American road-builders in Chicago. The signs can be read in the sunlight as clearly as when illuminated at night.

They will be placed at many important junctions on public highways, where they will aid tourists by giving directions.



How the signs appear at night

Below is a new type of mill designed to catch more power from the wind



### Turns Wind Power into Electric Current

IN THE design of a revolutionary new type of windmill called the "aerodynamo," which converts wind power direct into electric current, Major Bilau, a German inventor, believes he has discovered a valuable source of economical power.

It is claimed that the aerodynamo can utilize 50 per cent of the wind's energy. It differs from previous windmills in the fact that the wind wheel is placed to the lee of the tower or mast supporting it. A

vane of special design, placed to the windward, sweeps the wind directly to the back of the wings, where it can exert the most power. In previous types of mills the wind stream has been broken up behind the wheel, where the vane has been located. Thus much of the wind's energy was lost.

The photograph shows the arrangement of wheel and vane; also the small vanes that are attached to the wings and that add to their power.



### Dry-Land Houseboat "Sails" on Artificial Lake

WHILE he lived on a hilltop, H. A. Heroux, of Oakland, Calif., longed for sea life. So he built a house in the shape of a boat, surrounded it with an artificial lake, and now enjoys cool breezes from the deck of his unique home.

In the heaviest of storms the occupants have no fear of seasickness since the house is stationary, having a concrete foundation.

It cost the skipper-owner, who is shown in the photograph above, \$20,000 to construct his odd boat-house.





### Sanitary Kit for Baby's Bottles and Wardrobe

A BABY kit for carrying the baby's clothing and milk when away from home has been introduced recently to take the place of makeshift bags, commonly used for that purpose. The kit is lined with washable blue or pink rubber and in the bottom of the case are aluminum bottle holders.

Clean clothes may be packed in a pocket in the lining, while soiled clothing is carried in a rubber pocket entirely outside the bag proper, a notable sanitary feature. This compartment is removable. The bag is waterproof and the exterior as well as interior can be washed with soap and water.

### Know Your Car

ONE of the best ways to start the motoring season right is to give your car a thorough cleaning. This should include the top and upholstery, too often neglected.

Sweep off the top first. If the top is leather, a mixture made of half a cup of turpentine, half a pint of raw linseed oil and four cups of water is a good cleanser. Apply with a clean rag and rub dry.

For mohair tops make a lather of a pail of tepid water and a bar of Castile soap. Use a large, clean sponge and wash the top well. Go over it with clear water to prevent streaking.

Plain water with a little ammonia will remove dirt from leather upholstery, after which the cushions should be rubbed with a clean woolen or flannel cloth. Do not use gasoline on leather.

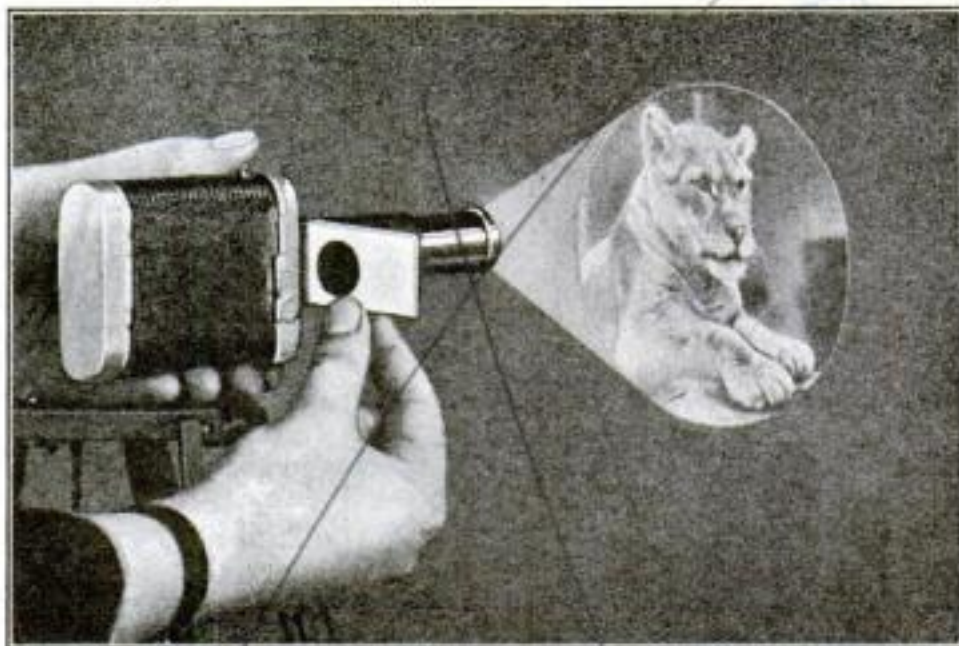
Cloth upholstery may be cleaned by rubbing it with a sponge dipped in the following mixture: Three-quarter ounce common salt, two ounces grain or wood alcohol, mixed with clear water. Lukewarm ivory soapsuds will remove grease or oil spots.

Clean all glass windows and reflectors with a mixture of half alcohol and half water.

## Pocket Light Projects Pictures

ONE of the latest novelties in entertainment is a small picture projector that can be carried in the pocket. The light necessary for projection is provided by an electric flashlight, and pictures can be thrown on any white surface. When in use, a telescoping lens is extended from the case. Tiny slides are inserted in the usual way. Although the entire outfit is hardly larger than a pocket flashlight, the pictures are said to be reproduced sharply and clearly.

In the photograph, the picture of a lioness is projected on a smooth wall.



Projecting the picture of a lioness on a white wall

AN AVERAGE of 30 per cent of the available power of gasoline for motors is being wasted by its discharge in the engine exhaust in the form of combustible gases, according to recent government tests.

### Fun for One on Spring Seesaw

FOR the child without a playmate an ingenious new mechanical seesaw operated with a spring, will provide hours of entertainment. No one is needed at the other end. The spring retards the descent of the child, and helps to pull him up again after his feet touch the ground.

The teeter is operated by the child's pushing the ground with his feet, or it can be swung with a body motion. It is equipped with a comfortable saddle and with handles to prevent the possibility of the small child's falling off. It can be moved easily from place to place.



A spring balances the lone rider on this ingenious new seesaw

### Wires Made Fireproof

FIREPROOF insulation for telephone switchboard wires is made possible by a newly discovered use for selenium, an element hitherto used chiefly in the control of electric current by light. The flameproofing of switchboard wires is highly important, for even a small fire can throw a whole exchange out of commission.

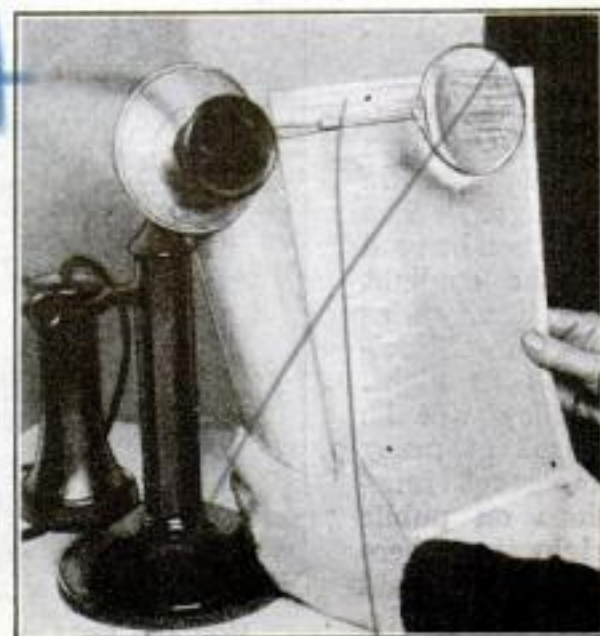
### Phone Numbers Magnified by Glass Attachment

A MAGNIFYING-GLASS that can be attached to any telephone aids in reading small type numbers in the telephone book. It folds out of the way when not in use.

### Wet Coal Is Costly

RECENT tests by the U. S. Bureau of Mines show that the wetting of coal is expensive to the consumer. Fine sizes of both bituminous and anthracite will hold up to 20 per cent in moisture, though larger sizes of the bituminous increase but little in weight when dampened.

Coal can have a perfectly dry appearance, yet still contain as much as 10 per cent moisture, for which the consumer pays. A moisture content of 12 per cent is not at all uncommon.



How the magnifying glass is attached



## Compact Sterilizer Aids Dentists



The new sterilizer held by the inventor, Dr. P. L. Nemmers

A DEVICE that keeps drills and other attachments used in dental work continuously sterilized is the invention of Dr. P. L. Nemmers of Chicago, Ill. For its compactness and the ease with which it is used it was commended by dentists at a recent national dental convention.

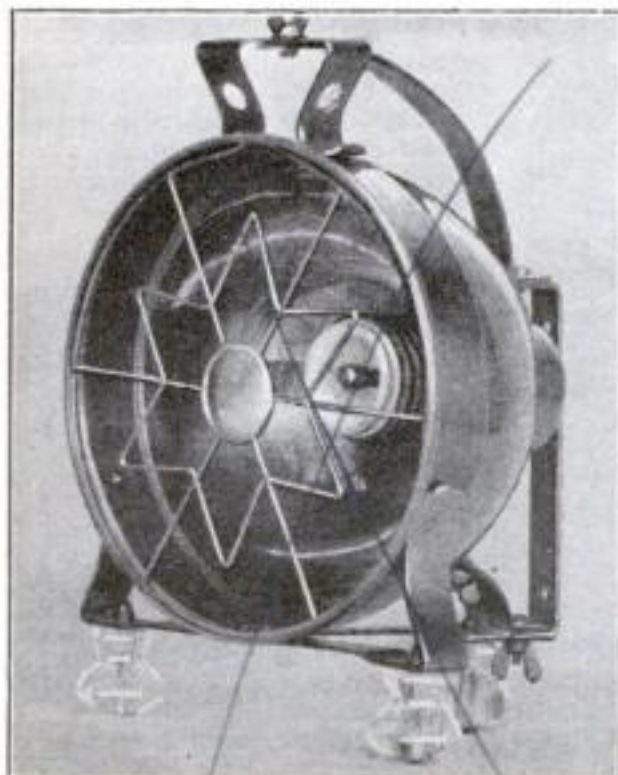
RECENT tests show that silk thread used in stringing pearls should not be dyed nor contain chemicals, otherwise the luster of the pearls may be destroyed.

## Portable Electric Heater Useful as a Lamp

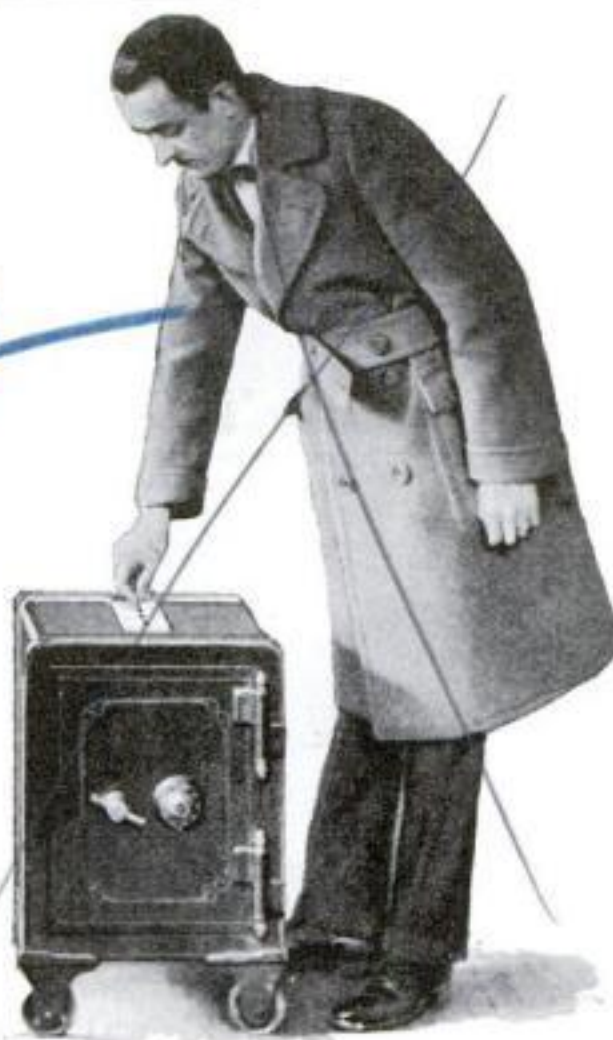
BECAUSE of the unusual shape of its reflector a compact new brass electric heater is said to focus intense heat in a given direction instead of diffusing it as does the usual bowl-shaped type of heater. For quickly heating small rooms, such as a bathroom or nursery, this feature is said to be advantageous, when time is important.

Its heating element is of a screw socket type that is easily renewable. An electric-light bulb can be substituted for illumination, if desired, the reflector producing a powerful beam of light.

The heater rests on heavy glass supports. It is equipped also with an adjustable metal bracket with screw holes, by which it may be attached to the wall in any desirable place. It is provided also with a 15-foot extension cord. It can be used on either direct or alternating current.



New electric heater with wall brackets



## Chicago Churches Install Offering Safes

DURING a crime wave in Chicago recently the collection boxes in so many churches were stolen that specially designed burglar-proof offering safes were installed in 30 churches.

Three slots in the top of the safe are provided to receive as many kinds of offerings, which drop through chutes into compartments reserved for them. Sharp teeth at the end of each chute prevent the possibility of a thief's stealing the coins by lowering a sticky substance on a string from outside. The safe is of extremely heavy construction to prevent any attempt to remove it bodily.



## Concrete Surfacing Tool Driven by Motor

FINISHING the surface of concrete after the rough work is completed, removing irregularities, and preparing the surface for painting are hand processes that long have been expensive. A simple new portable surfacing machine driven by electricity recently has been perfected to do the work in much less time. Its fine cutting action is said to produce a much better surface.

The machine can be used also to produce special finishes on imitation stone, to cut brick walls preparatory to applying stucco, and to grind paint from bricks. In use, the motor hangs at the side of the worker, and is slung from a strap over his shoulder, leaving both hands free to operate the light power tool.

## How Much Science Do You Know?

HERE are a dozen simple questions such as might be put to you any day. How many of them can you answer intelligently?

Answer each one to the best of your ability, then turn to page 144 and see how nearly you were right.

Twelve more questions will appear in next month's issue.

1. How much water is there in an inch of rain?
2. Why can deaf persons sometimes hear through their teeth?
3. What are phonograph records made of?
4. Why do bubbles collect inside of a glass of water standing in a warm room?
5. What do fishes eat?
6. Why is the moon sometimes seen in the daytime?
7. Why do moth balls get smaller and finally disappear when put away with clothes?
8. Can elevator motors interfere with radio reception?
9. Will the earth ever stop spinning?
10. Why does being near a dynamo sometimes spoil your watch?
11. What is a candlepower?
12. Why do people yawn?



# Science Eases the Labor

## New Fixtures for Kitchen and Bedroom

The flexible metal nozzle of the oilcan at the left makes it invaluable for reaching awkward corners in the carpet-sweeper's or the vacuum cleaner's out-of-the-way joints

An egg-beater that fits an ordinary drinking-glass has a combination motion. A whirling propeller throws the egg into the center of the glass, where it is caught by a dasher and plunged up and down until beaten enough

Slicing eggs or beets can be accomplished neatly and quickly by this device, which is made of a grid of fine wire that is pressed through the food

A rubber base with small projections keeps this new sugar dispenser from sliding over tables that have polished wood or glass tops. The base is removable for washing

Double shoe-trees keep shoes together on a hanger. Pressure is exerted from arch to toe, leaving no strain on the heel. A small hook in the center hangs the trees on the rack

Clothes-hangers to suit every need can be found nowadays. The one above is particularly useful because it will swing three ways and collapse or expand as the occasion demands

This collapsible clothes-hanger is useful for hanging dresses, coats, or trousers. The sliding sides are adjustable to several sizes and allow easy packing. The top hook folds in

A hair-drying comb will prevent colds after shampooing. One part of the comb is heated, then inserted into the comb proper, which being of aluminum, readily conducts the heat

Keeping a comb clean is an easy matter with the device shown above. It is held like a razor strop, hooked at one end to an adequate support

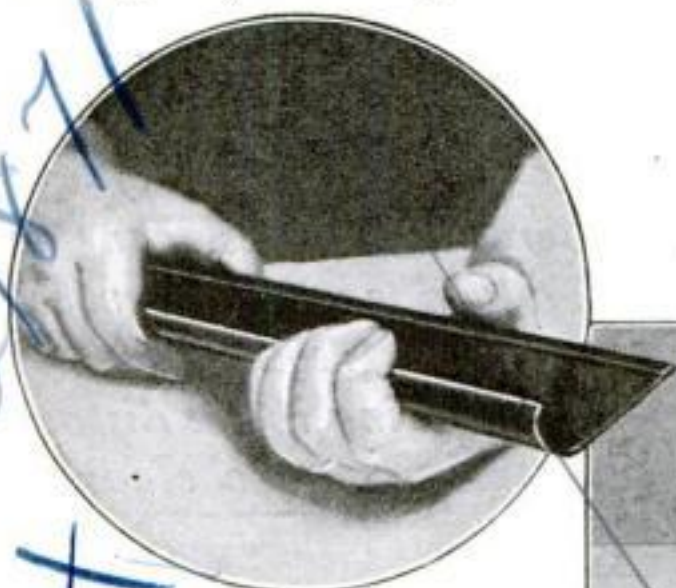
An automatic stand for the electric iron prevents overheating of the iron, as the current runs only while the iron is in use or off the stand



# of the Modern Housewife

Simplify Many a Home-Making Problem

Fish-scaling will be found a less disagreeable task with this new scaler. The handle is elevated so that the hand grasps it easily, and the many teeth finish the unpleasant job quickly

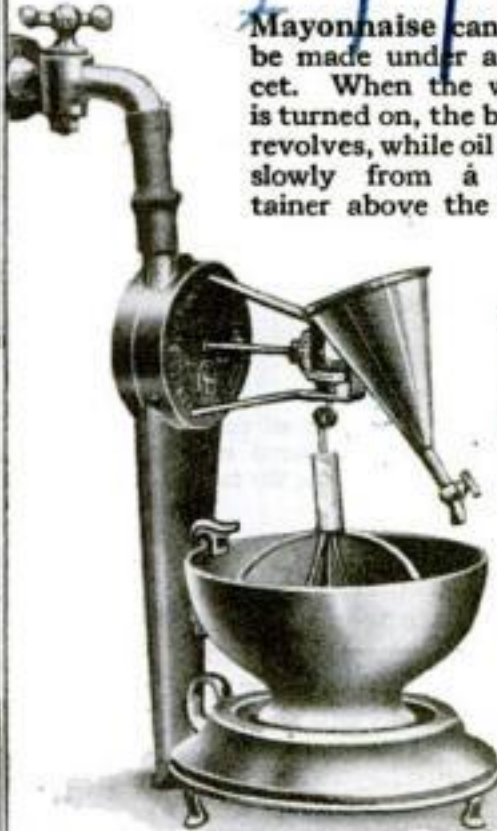


To prevent drafts, a light, strong strip of bent metal is designed to be slipped under the door and fastened by two screws. Tightening the screws adjusts the strip to its frame



A stool in the kitchen means rest for the housewife. This white enameled seat that swings in under the sink will save nerves and backache and insure cheerfulness and added efficiency

Mayonnaise can now be made under a faucet. When the water is turned on, the beater revolves, while oil drips slowly from a container above the bowl



A cone-shaped aluminum egg-separator that fits on top of an ordinary tumbler, prevents broken yolks. The white runs slowly through a slotted section, leaving the yolk in the top of the metal separator



This new dish-dryer has graduated bins that keep delicate and heavy china separated, preventing much unsightly chipping



This built-in garbage receiver is convenient and sanitary. When the door is opened, the can swings out with it. The hinged metal door keeps in unpleasant garbage odors



Even children can grade eggs with this new invention. When an egg is put in the grader, the beam automatically adjusts itself. The lowest visible number indicates the weight of one dozen eggs of the same content

This safety can opener keeps the can at a distance. Turning the key clockwise makes the can revolve, and a sharp-edged steel wheel neatly cuts off the top

For condensed-milk or syrup containers this can-opener and spout is useful. A sharp point is pressed into the lid and given half a turn to fit it snugly into the hole





# How to Build a Radio-Frequency Amplifier

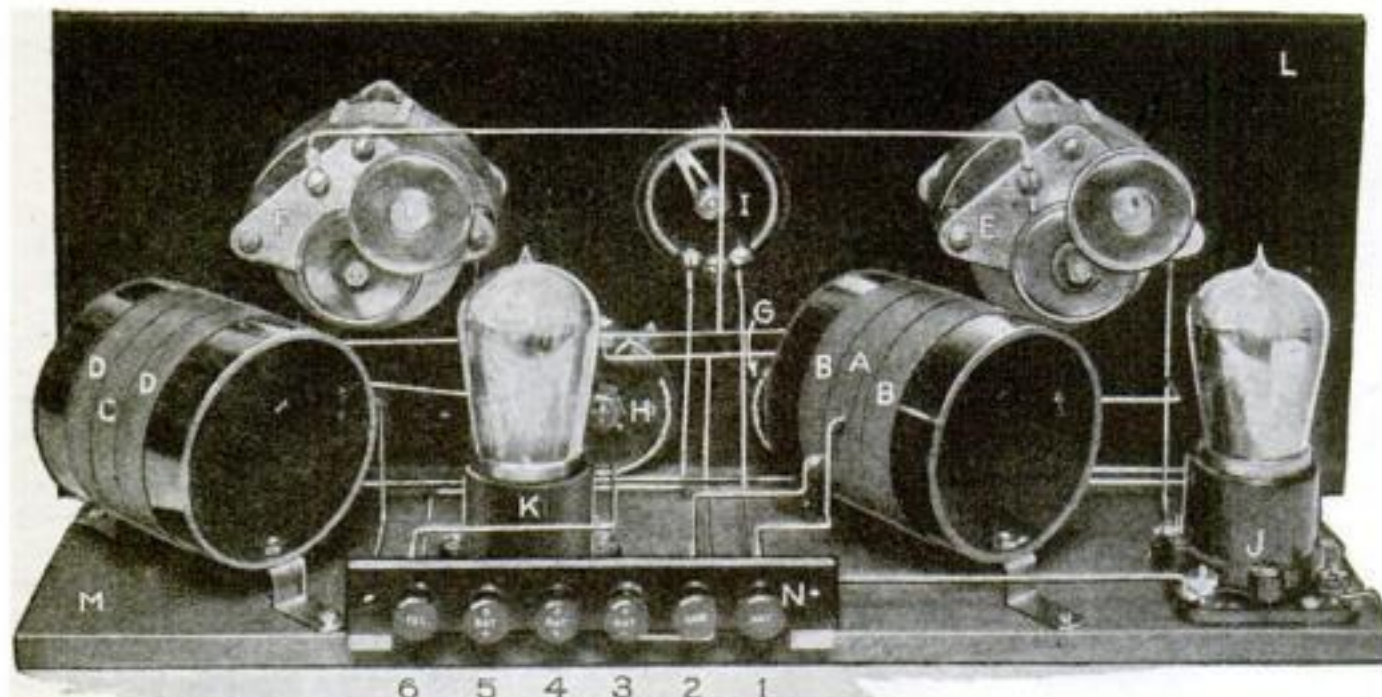


Fig. 1—Rear view of two-stage radio-frequency amplifier, showing layout of parts and wiring. The parts are lettered and numbered to correspond with wiring diagram below. Note brass brackets supporting the tuning units. These were made by bending the ends of right-angle brackets

**I**F YOU already have built a regenerative receiver, the chances are that you are wondering how you can add radio-frequency amplification without having to rebuild your whole outfit.

This article will show you how to do it. And there is nothing tricky about the circuit either—anybody who can get a regenerative receiver working properly will have no trouble at all in adding two stages of radio-frequency amplification to his set.

Do not build this radio-frequency amplifier with the idea that it will increase the strength of the signals from powerful local stations, for if you already use a good outdoor antenna, there will be no appreciable increase in the volume; that is not its mission.

Radio-frequency amplification will be a big help, however, in bringing in distant stations, and—what is still more important to many radio fans—it will greatly increase the selectivity so that you will be able to get the distant stations right through the locals when conditions are at all favorable. If you follow the instructions carefully, you should have a set that will give the greatest satisfaction.

**FIGURE 1** shows a wiring diagram of the radio-frequency amplifier, and you will note at the right a coil marked X. This is the coil used to couple the radio-frequency amplifier to the receiver you now have. Detailed instructions on how to use this coil will be given further on.

Hooked to an ordinary regenerative set, this amplifier unit enabled the writer—in New York City—to bring in WTAS at Elgin, Ill., and several other distant stations with plenty of volume early in the evening when all the locals were on the

## The Parts You Need:

- A and B—First tuning unit
- C and D—Second tuning unit
- E and F—Variable condensers, .0005 mfd. maximum capacity
- G and H—Rheostats
- I—400-ohm potentiometer
- J and K—Vacuum-tube sockets
- L—Panel, 7 by 18 inches
- M—Wooden baseboard, 6 by 17 inches
- N—Binding-post strip,  $\frac{1}{4}$  by 6 inches

Two pieces of composition tubing, 3 inches in diameter by 3 inches long; two dials (if they are not included with the variable condensers); six binding posts, brass right-angle brackets, bus wire, and wood screws.

air. The same stations could not be tuned in on the regenerative receiver alone without considerable interference from the local stations.

The radio-frequency-amplifier unit adds two tuning controls, to be sure, but since it eliminates the need for a tickler in the regenerative set and also dispenses

*THIS simply designed unit of one or two stages can be added to your present set without rebuilding. It will bring in the distant stations more clearly.*

By Alfred P. Lane

with antenna tuning where this is used, the total number of tuning controls remains at three—the two dials of the radio unit and the dial of the secondary condenser or grid variometer in your present set.

It is quite possible that the radio-frequency amplifier as illustrated does not match the design of your present receiver either in size or in the arrangement of the binding posts.

**T**HE panel L was made 7 by 18 inches because so many radio constructors favor this size and the binding posts are mounted at the back on strip N, since this is the style at present. If your receiver is built with the binding posts on the panel, you can follow the same style in the radio-frequency-amplifier unit by placing binding posts Nos. 1 and 2 at the left end of the panel, as seen from the front, with binding post No. 6 at the right end opposite the antenna binding post of your present set. Leave the remaining four binding posts, which are for the battery connections, where they are shown in Fig. 1.

The radio-frequency-amplifier unit will give best results with  $\frac{1}{4}$ -ampere storage-battery tubes and 90 volts of B battery; but dry-battery tubes can be used with satisfactory results, although it may be necessary to add three or four turns to coils C and X when the smaller tubes are used.

You will note that there is no binding post for the minus-B-battery connection. This has been left out purposely. Ordinarily the minus-B-battery binding post is connected with the plus-A-battery binding post, but since this connection with the filament circuit has been made already in your present set, it is useless to do it again. Besides, if by chance the minus-B-battery lead in your set is connected with the minus-A-battery wire instead of with the plus, an additional connection in the radio-

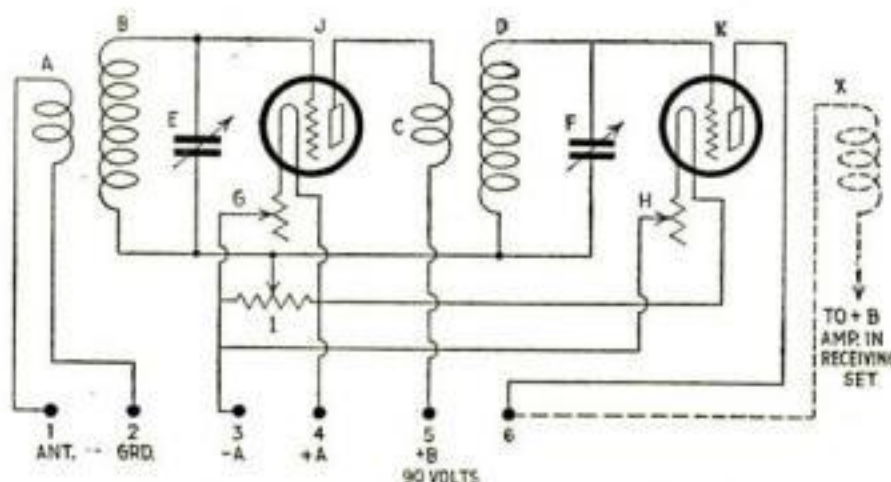


Fig. 2—Wiring diagram. The coil X is built into your receiver, as shown in subsequent diagrams (Figs. 7, 8, and 9)



frequency-amplifier unit might short circuit your storage A battery with rather disastrous results to the wiring, to say nothing of the effect on the battery itself.

**T**HE tickler coil, or plate variometer, should be cut out of the plate circuit of the detector tube in your set when used with this radio-frequency-amplifier unit because you can get the set up to the point of oscillation on any wave length by adjusting the potentiometer *I*.

There are many other ways to control oscillations in radio-frequency amplifying circuits besides the potentiometer, and some of them could be used very well in place of this instrument in the amplifier as constructed. However, the potentiometer arrangement is foolproof, and a slight adjustment of it will compensate for variations in different tubes, coupling between stages, and so forth.

The use of a separate rheostat for each tube is worth while, since often two tubes have slightly different characteristics. One tube may require a bit more current than the other for best results.

Those fans who desire to build a one-stage radio-frequency-amplifier unit instead of a two-stage can do so very easily. Just eliminate parts *C* and *D*, *F*, *H*, and *K*, and connect the plate terminal of socket *J* with binding post No. 6 instead of with coil *C*.

**T**HE parts you will need are listed on page 74.

The sockets *J* and *K* and the rheostats *G* and *H* should, of course, be chosen to suit the tubes you use. A 200-ohm potentiometer will do just as well as the 400-ohm one specified, although the higher the resistance of the potentiometer, the less current it will drain from the A battery.

After you have bought all the parts, lay out the panel according to the diagram in Fig. 4. Note that only the location of the holes for the shafts of the instruments



Fig. 3—Panel layout. The knob controlling the potentiometer *I* is shown between the two condenser dials. It controls oscillation. Place the binding posts on panel if you so desire

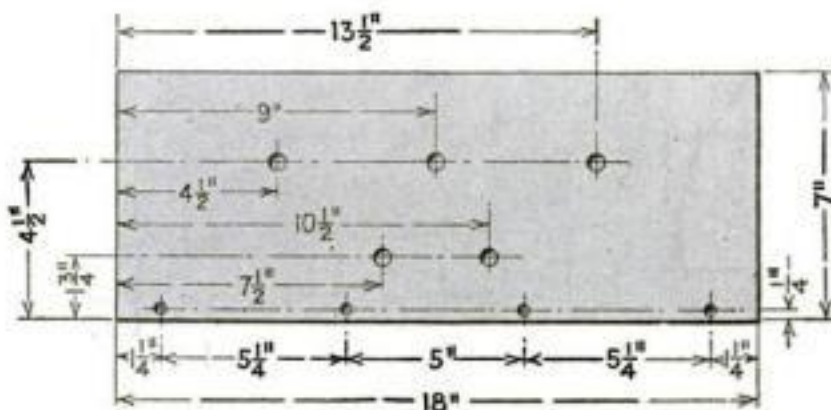


Fig. 4—Diagram for drilling the panel, with exact measurements indicated. Only the holes for shafts are given. Lay out holes for supporting screws from templates supplied with the instruments

is given, since so many instruments are single-hole mounting, and the ones that require holes for mounting usually are supplied with templates. The easiest way to drill the panel without scratching it is to mark off the locations of the holes on a piece of paper the exact size of the panel. Then paste the paper on the panel with library paste and drill the holes right through the paper after you have made a deep center punch mark for the center of each hole. After the holes are drilled the protecting paper can be washed off.

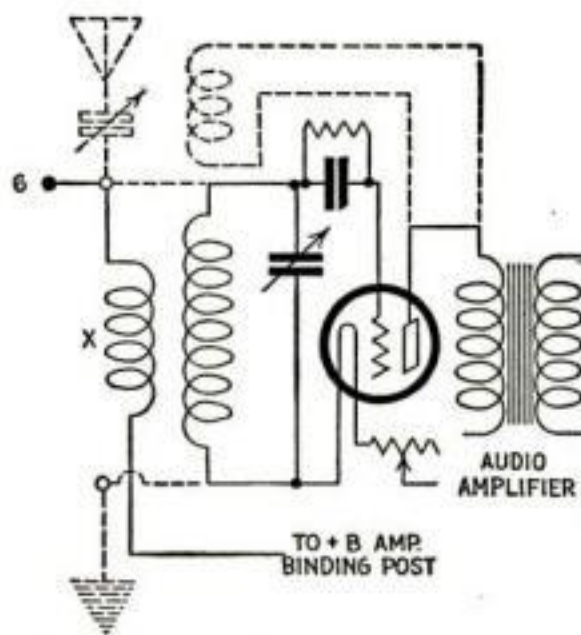


Fig. 7—This wiring diagram shows how to connect the radio-frequency-amplifier unit with a single-circuit set. Coil *X* should consist of four turns of bell wire wound around the secondary coil. All parts and wires shown in dotted lines should be eliminated

The panel is fastened to the baseboard by means of four round-headed wood screws. The locations of these screw holes are included in the panel layout in Fig. 4. Mount the instruments on the panel as shown in Figs. 1, 5, and 6. It is well to set the condensers *E* and *F* with the plates up instead of down to allow more room for the coils.

The winding of the coils is the next step. They are wound on composition tubing 3 inches long by 3 inches in diameter and mounted on the baseboard by

means of brass brackets, as shown in Figs. 4, 5, and 6. Coil *A* consists of 8 turns of No. 22 double silk-covered wire centered on the tube. The terminals of this coil are brought out as shown in Fig. 1, where they are convenient to binding posts 1 and 2.

Coil *B* consists of 25 turns on each side of coil *A*, with the inside ends of the two sections soldered together inside the tubing. The direction of winding makes no difference in any of the coils except that the two sections of coils *B* and *D* must be wound so that the current flows in the same direction around the coil from one end to the other.

**T**HE simplest way to fasten the ends of the wire is to drill two small holes about one-quarter of an inch apart where the end of the wire is to come, and pass the wire through and back. The two pairs of holes for the ends of coil *A* should be one-quarter inch apart and the two holes for ends of coil *B*, which are nearest to coil *A*, are naturally the same distance apart.

Only two holes are necessary for the two ends, since they are soldered together inside the tube as shown in Fig. 1. Each half of the winding of coil *B* is three-quarters of an inch long and you can drill the four holes for the outside ends of coil *B* on the opposite side of the tube 1 3/4 inches apart.

Tuning unit *CD* is just like *AB*, except that all the wire ends are brought out on the same side. Coil *C* consists of 4 turns of No. 22 double silk-covered wire and coil *D* is wound with 25 turns on each side of coil *C*.

After you have mounted the tuning units *AB* and *CD*, the sockets *J* and *K* and the binding-post strip *N* with six binding posts screwed to it, all on the baseboard *M*, as shown in Figs. 1, 5, and 6, you are ready to proceed with the wiring.

The coils *AB* and *CD* should be set on the baseboard so that the axes of the coils make an angle of about from 55 to 60

(Continued on page 149)

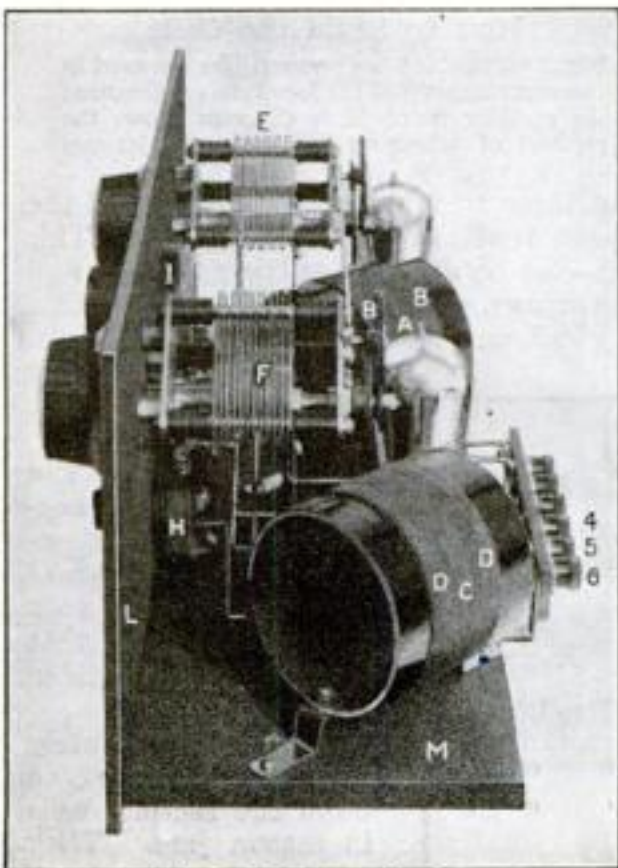


Fig. 5—Right-end view

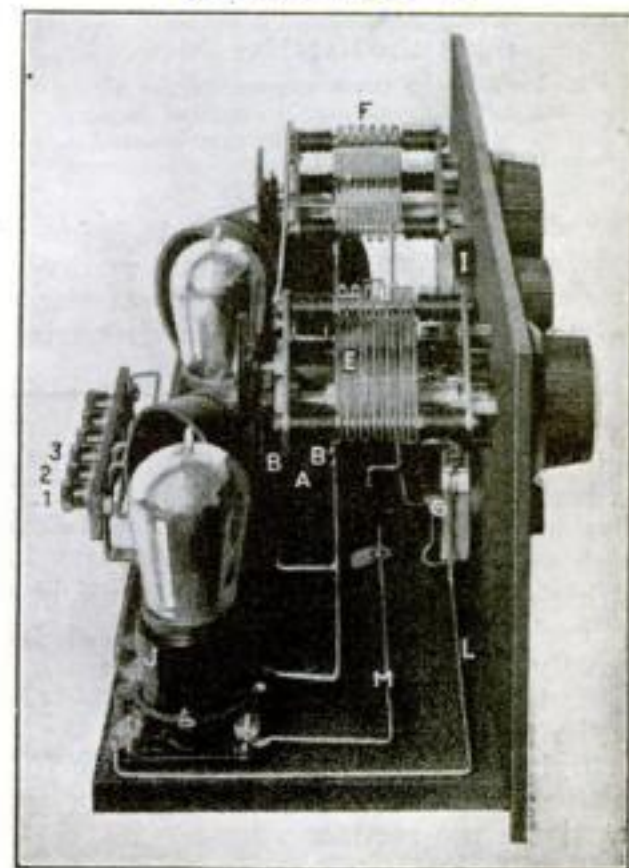


Fig. 6—Left-end view



# Alternating Light Current Will Do the Work of B Batteries

This Filter Circuit Should Cost Less than \$10 to Build

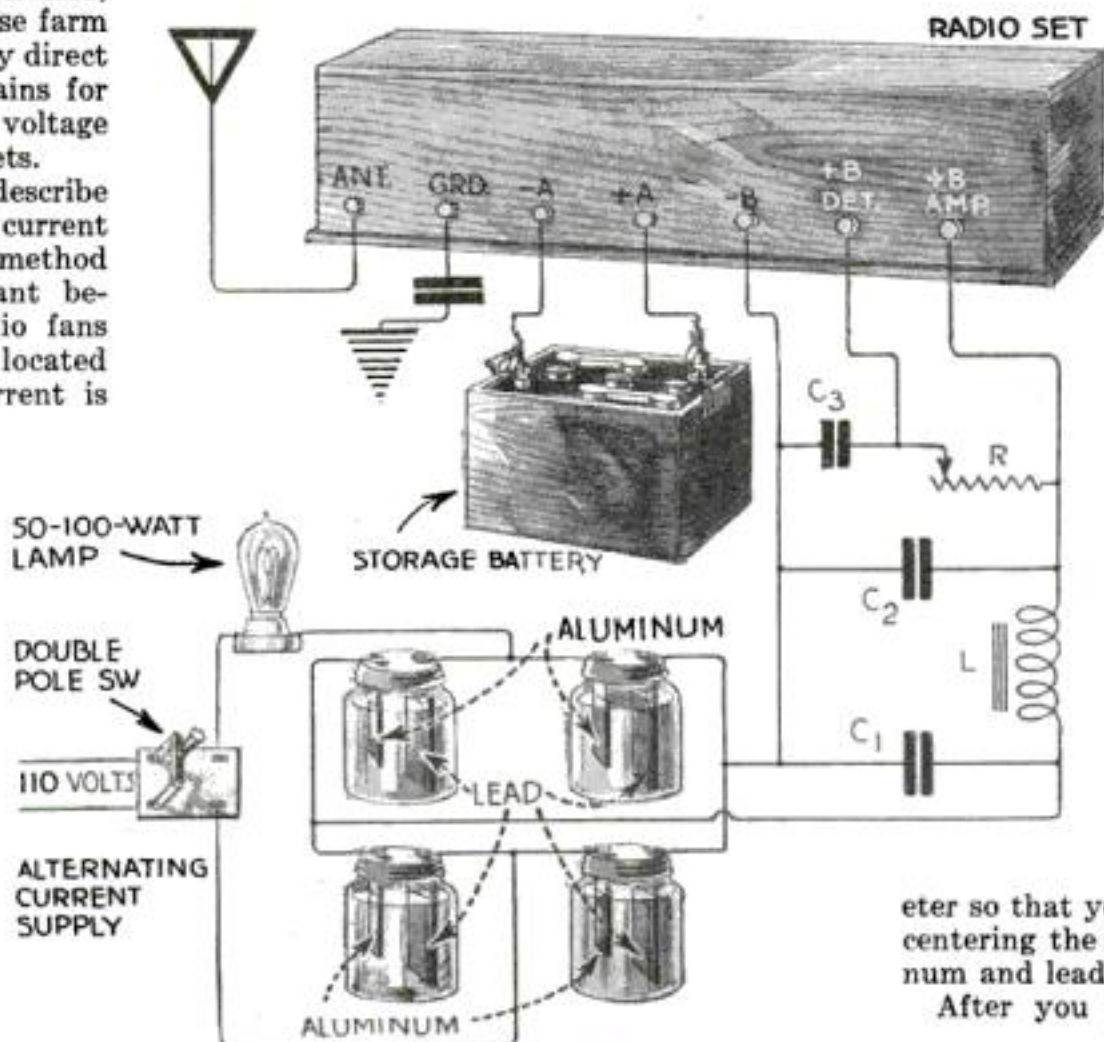
By Alexander E. Senauke, M.E.

IN PREVIOUS articles in POPULAR SCIENCE MONTHLY, I have shown how to use farm lighting current and ordinary direct current from the street mains for supplying the B-battery voltage needed by radio receiving sets.

In this article I shall describe how you can use alternating current for the same purpose. This method is relatively more important because the majority of radio fans throughout the country are located where only alternating current is available.

The first step in arranging to use this current for your radio set is to rectify it. Figure 1 gives a good idea of the result of this operation. At the top is a curve representing alternating current supplied to your house, and just below it is another curve showing the current as it leaves the rectifier.

You will note that none of the diagrams show how to use alternating current as a substitute for the A battery



The Hook-Up to Your Set

Fig. 2—This diagram shows how to wire the parts of the rectifier and connect it with your set. The values of the inductance, resistances and condensers you will need are given in the table at the foot of the page

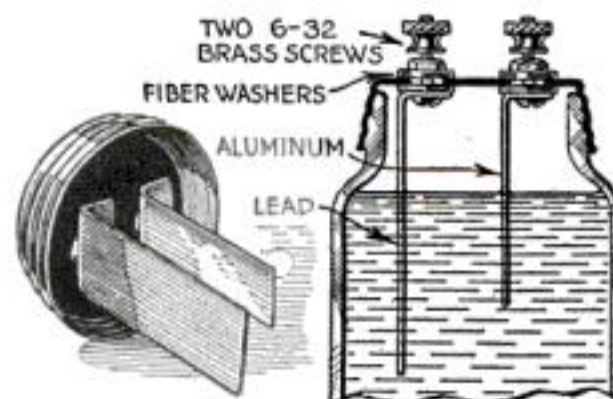
Standard one-pint jars are very satisfactory. The way to fasten the lead and aluminum plates to the cap of the jar is shown in Fig. 3. The aluminum plates should be made of the purest material obtainable and the area of aluminum below the top level of the solution in the jars should not be more than one square inch. The size of the lead plates is not important—two or three square inches of sheet lead will do for each cell.

The solution in the jars should consist of distilled water in which has been dissolved as much ordinary borax as the water will take.

A house-furnishing store will sell you the mason jars, the grocery store keeps borax in stock, and the plumber can supply the sheet lead and the fiber washers, shown in Fig. 3, which are used as insulators. The pure sheet aluminum is not so easy to obtain, but your hardware dealer will put you in touch with a source of supply if he has none in stock. The total cost of the four cells ready for use should be less than one dollar.

THE porcelain lining in the caps of the mason jars should be broken out with a light hammer and then the holes drilled as indicated. Make the holes at least one quarter inch in diameter so that you will have no difficulty in centering the screws that hold the aluminum and lead plates to the tops.

After you have the cells assembled,



How to Build the Cells

Fig. 3—Standard pint mason jars are used in constructing each of the four cells constituting the rectifier unit. This diagram shows the method of attaching the plates to jar top

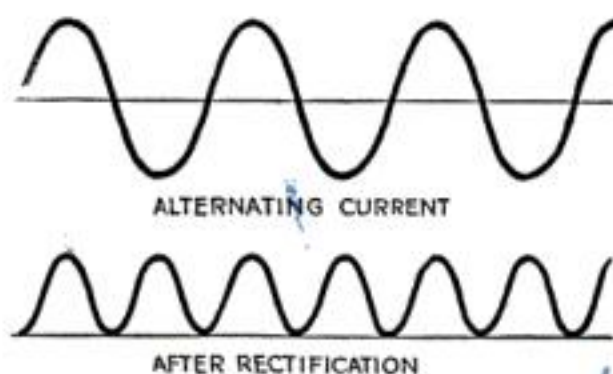
test them to make sure that none of the screws touch the metal of the cap. This can best be done by putting the cap and the screws, one at a time, in series with a dry cell and an ordinary buzzer or bell.

If the bell does not ring, there is no short circuit.

Be sure to drill a small hole about one-sixteenth inch in diameter in the center of each cap to serve as a vent for the gases that form while the rectifier is in operation.

It is not absolutely necessary, of course, to build the rectifier cells in mason jars. They

(Continued on page 151)



What the Rectifier Does

Fig. 1—The top curve represents the alternating light current that is supplied to your house, while the lower curve illustrates how it leaves the rectifier as direct current

as well as for the B battery. It is possible, of course, to build a current-rectifying device that will eliminate all batteries, but the construction of such a circuit is beyond the scope of ordinary amateur work.

Figure 2 shows how to lay out and hook up a complete B-battery eliminator that will work on 110-volt alternating current of 50 or 60 cycles such as ordinarily is supplied for house lighting.

The four mason jar rectifying cells at the bottom of the diagram constitute the rectifier portion of the unit.

## The Values to Use with Your Set

The following table tells you the values you will require for the inductance  $L$ , the condensers  $C_1$ ,  $C_2$ , and  $C_3$ , and the resistance  $R$ , according to the number of tubes in your set:

Number of Tubes	Inductance of $L$	Allowable D.C. Resistance of $L$	$C_1$	$C_2$	$C_3$	$R$
3	5-20 henries	2000 ohms	2 mfd.	4 mfd.	2 mfd.	5000 to 10,000 ohms, variable
5	"	1500 "	4 "	4 "	2 "	" "
7, 8, or 9	"	1000 "	6 "	8 "	2 "	" "



# The Month's Novel Radio Ideas

## New Inventions for Receiving Sets and Broadcast Stations

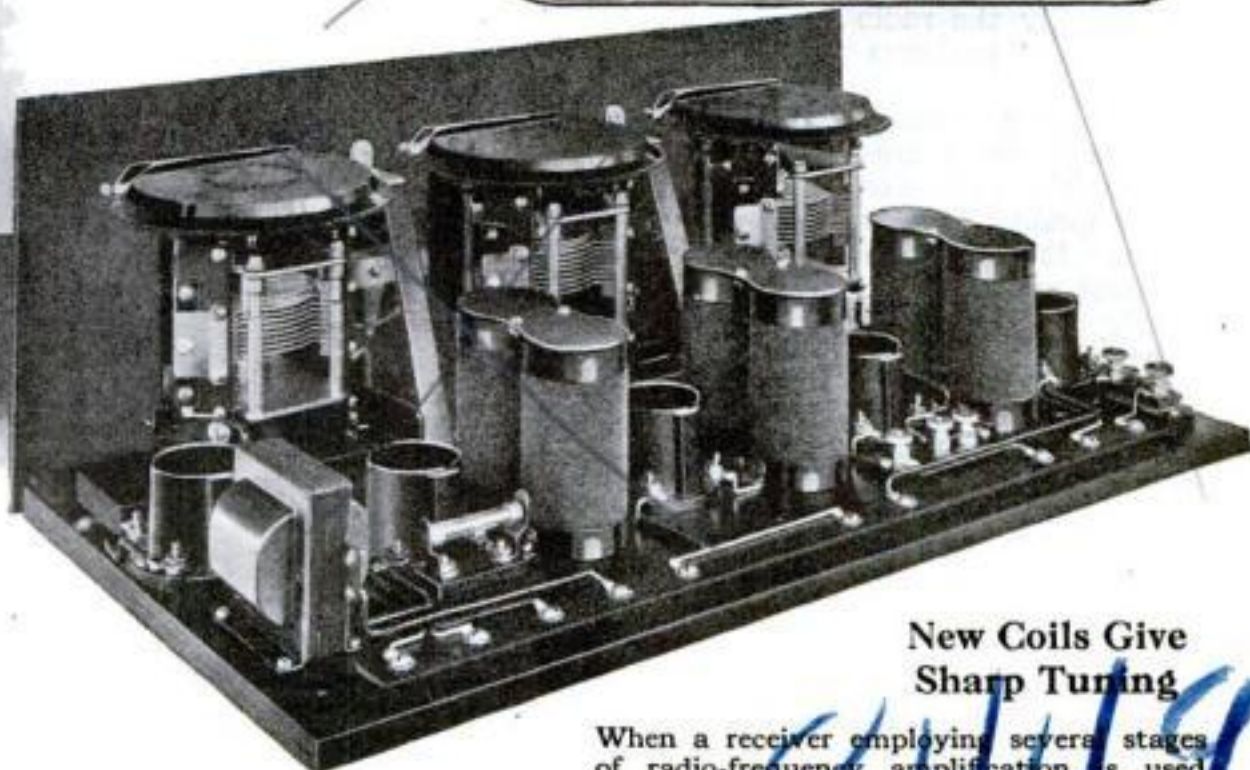
### Tiny Station

Although thousands of amateur radiophone stations use power as low as five watts, WDBX in New York City is the only regularly licensed radio broadcasting station in America with only one five-watt tube to supply energy to the antenna. Samuel McMullen is shown at the relatively tiny control board of WDBX.



### Grandfather's Clock Up to Date

This modern version of the grandfather's clock attracted considerable interest at the first radio show ever held in Germany. It is wound automatically and is set for the German standard time by radio. A loudspeaker for broadcast reception is just below the pendulum, while a receiving set and battery compartment take up the rest of the space in the cabinet. In this view the tall door of the cabinet is open to give access to the neatly arranged radio set.

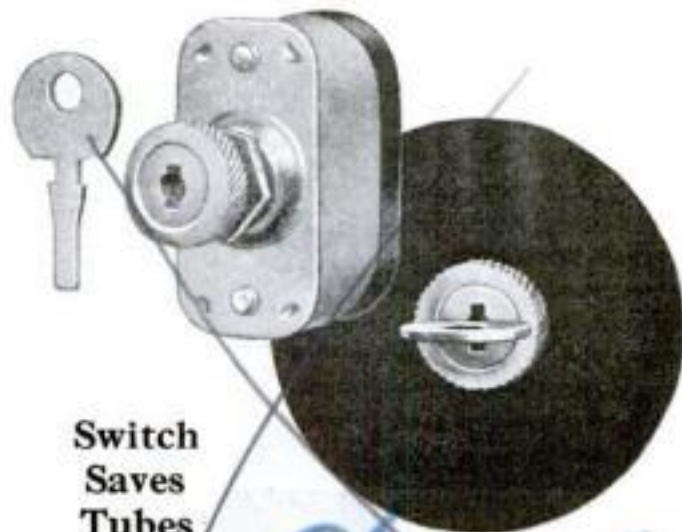
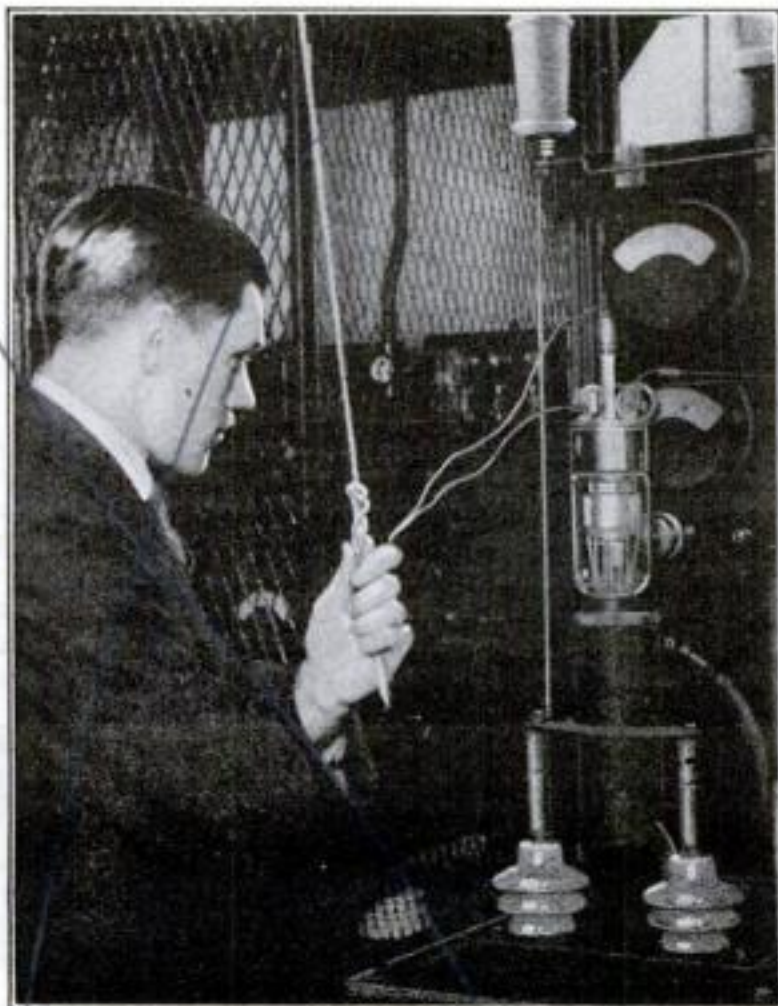


### New Coils Give Sharp Tuning

When a receiver employing several stages of radio-frequency amplification is used near a powerful broadcasting station, the coils themselves act as loop antennas so that it sometimes is difficult to tune out the local station. One manufacturer claims to have solved this trouble by shaping the coils like a binocular and eliminating interstage coupling. Radio waves reaching the coils, except by the antenna, are balanced out.

### Giant Tubes for Oversea Radio

Here is one of the new water-cooled vacuum tubes that are being manufactured for the British Government wireless station at Rugby, England, to be used for radio communication with New York. They are said to be many times more powerful than any tubes now in use. The valves are tested with a current at a voltage of 15,000. The operator stands by with a cord connected with the power supply so that it can be shut off from the tubes instantly in case of an emergency.



### Switch Saves Tubes

Owners of radio receiving sets installed in homes where there are small children will appreciate the advantages of locking up the receiver when it is not in use. This switch lock takes the place of the ordinary switch operated by a button. The key turns off the filament circuit so that the set cannot be used.



# How to Select Your Loudspeaker

An expert helps you choose an instrument that will give undistorted reproduction of radio voices and music

By Arthur A. Stuart

AS FAR as quality of reproduction is concerned, the radio receiver and the loudspeaker are the Siamese Twins of radio. The former converts the high-frequency radio impulses into much more powerful electrical pulsations at audible frequencies. These, in turn, are transformed into sound vibrations by the loudspeaker. Should the radio receiver deliver distorted electrical impulses to the loudspeaker, the result is bound to be poor reproduction. And it is equally obvious that nothing but unsatisfactory speech and music can come from a low grade loudspeaker, no matter how perfectly the radio receiver itself performs its functions.

People who possess an ear for music naturally are in a better position to pass on the musical quality of a loudspeaker. It is unfortunate that some radio dealers apparently have no ear for music at all, judging from the raucous blare they persist in sending out over the public streets by way of loudspeakers installed in transoms over doors. In almost every case of this kind, quality has been sacrificed in order to attain the maximum volume, and the ears of passing pedestrians are assaulted by a noise well calculated to drive any thought of owning a radio receiver out of their heads.

This brings out one point that is important—you cannot always rely on the dealer's opinion as to the best loudspeaker. It is a question you must decide for yourself, and if you have no ear for music you should call in some friend who has the ability to help you.

The advice of any reliable radio dealer can be depended on with respect to all other items of your radio equipment if you will tell him exactly what you want in the way of results, for the factory-made receivers of today are nearly all capable of excellent results as far as quality is concerned.

Perhaps the first question to be decided is the matter of volume. Do you want to fill the house with music or will you be satisfied with enough volume so that you and your friends can hear

clearly if you are in the same room with the loudspeaker?

This is a vital point, for upon it hinges the amount of money you will have to

attempt to get the music or speech loud enough to be heard all over the house, distortion has to be compensated for in every possible way—and this means careful design, precise manufacturing methods, and much testing and adjusting. Naturally the cost of such loudspeakers is high.

It is claimed by experts that a good pair of head phones costing less than \$10 will give you as good, if not better, reproduction than can be obtained from the very finest loudspeaker money can buy. This is because the head phone is called on to give out sound vibrations of relatively small magnitude.

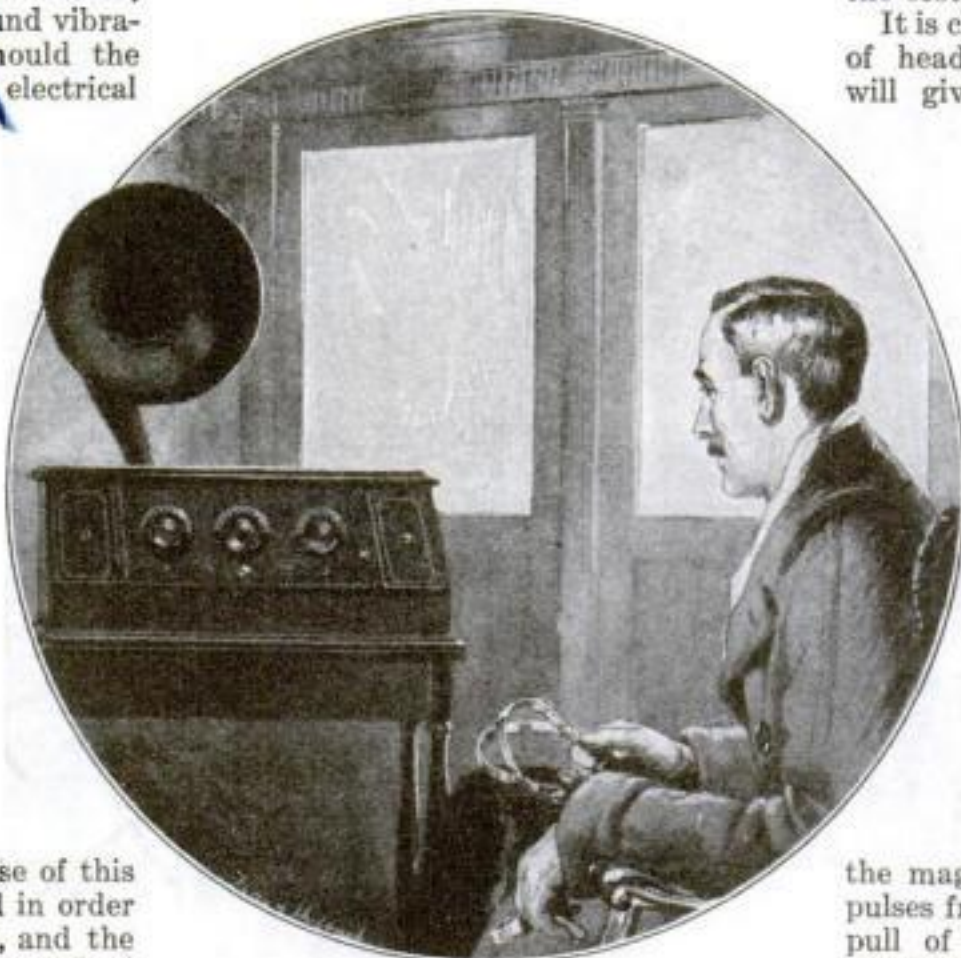
To understand what causes the distortion, it is necessary to know something of the mechanism used to transform the electrical impulses into sound vibrations in the air. The head phone is the simplest example. It consists of a permanent magnet arranged so that the poles of the magnet exert a constant pull on a thin disk of iron called the diaphragm. Coils of fine wire are placed on the poles of the magnet in such a way that

the magnetic effect of the electrical impulses from the radio receiver change the pull of the permanent magnet on the diaphragm and it moves back and forth in time with the electrical impulses. The vibration of the diaphragm is what causes the sound waves in the air.

The permanent magnet naturally exerts the strongest pull on the diaphragm if placed very close to it, and this fact accounts for some of the distortion. Strong electrical impulses cause the iron diaphragm to vibrate so far that it bumps against the ends of the pole pieces with a chattering sound, and if the spacing is increased, the weaker impulses are lost altogether.

Many loudspeakers are equipped with an adjustment to regulate this spacing to compensate for loud signals, strong plate current, and so forth. In a number of models, the diaphragm is made of mica or aluminum connected with a small piece of iron, called the "armature," placed in the field of the permanent magnet. The connection

(Continued on page 148)



You can judge whether a loudspeaker produces good quality by listening with head phones on the detector stage, then listening to the loudspeaker, and comparing the two



A typical homemade loudspeaker, consisting of an old phonograph horn to which is attached a single head phone. Such an outfit will give excellent quality of tone at low volume

spend for a loudspeaker. Volume and quality do not go hand in hand. High quality with small volume is relatively easy to attain, but the minute you

connected with a small piece of iron, called the "armature," placed in the field of the permanent magnet. The connection



Beware of the loudspeakers that over-emphasize a few notes on the musical scale or a few tones in the human voice



# What Does "Low Loss" Mean?

A much-abused radio term explained to safeguard you against inferior parts parading under false colors

SOME time ago, back in the dark ages of radio, a young man who was interested in amateur radio transmission and reception on the shorter waves, made a serious attempt to design a radio receiver for use on these waves with the idea of reducing some of the losses that were hampering his reception of distant signals.

He succeeded in working out a receiver that gave uncommonly good results, and in describing his outfit for one of the radio magazines, he hit upon a brilliant thought. He called it a "low-loss" receiver. Other amateurs experimented along similar lines, and before long "low-loss" construction was the main subject of conversation in amateur circles.

Manufacturers of radio apparatus quickly saw the advertising possibilities of such a catch phrase, and new pieces of radio apparatus designed for use on the broadcast wave lengths began to appear on the market tagged with the mystic words, "low loss."

Radio fans were interested at once, and soon it looked as if no maker of radio apparatus, regardless of the quality of his product, could possibly stay in the radio game unless he, too, brought out a line with the magic slogan on the boxes. And that condition exists today in spite of the fact that a number of the parts now on the market labeled "low loss" have no more rightful claim to the label than the man in the moon.

THERE is no mystery about the "low-loss" idea. A "low-loss" condenser is simply one that performs its electrical functions in a highly efficient manner. Because a variable condenser has metal end plates and a grounded rotor does not prove that it is electrically efficient. As a matter of fact, it may actually have greater losses than a condenser with molded end plates. Care in construction and the quality of the materials used are more important than any particular style.

Every new model brought out by a reputable manufacturer is quickly followed by a number of imitations. Outwardly, at least, two condensers may appear to be equally good, but one condenser may be insulated with the best material obtainable, while the imitation contains insulation like the original only in color and finish.

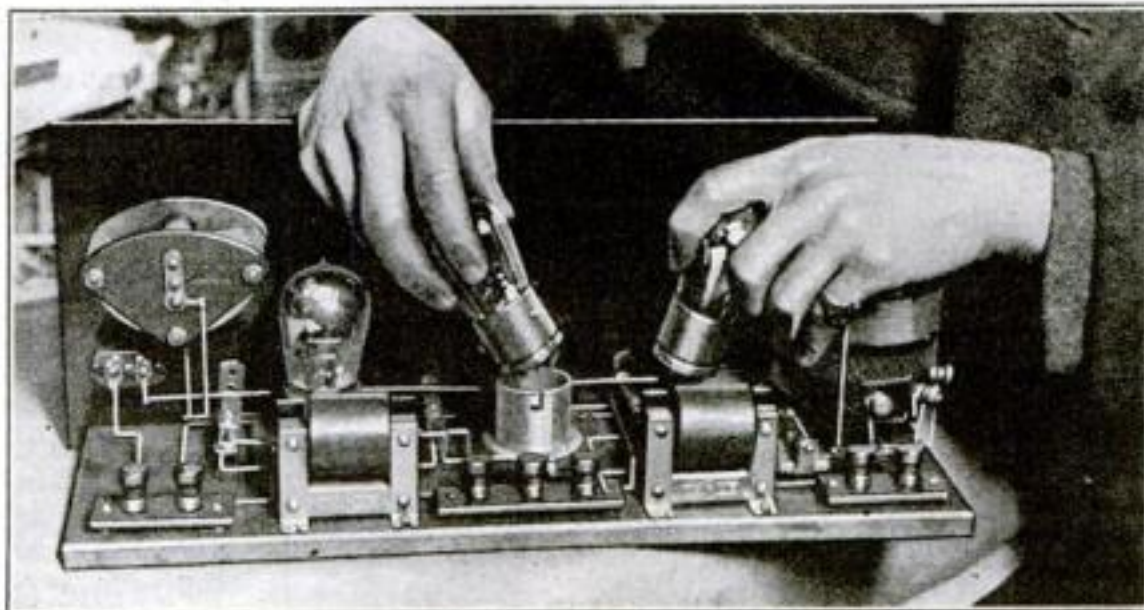
Spacing washers may be turned out by screw machines with perfectly flat,

By John Carr

smooth surfaces on both sides, or they may be punched out in a press, with the result that they are burred on one side and bent on the other. After assembly, the punched washers are polished on the outside and they look well to the prospective buyer, whether they are making good contact with the plates or not.

The qualities that entitle a variable condenser to be called "low loss" may be stated in a few words: Good insulation in the right place and not too much of it,

minimum amount of supporting insulation, and actually live up to the claims of the makers. Others are "low loss" in name only. They are wound with a poor grade of wire, often with defective insulation, and with metal braces in the wrong place. The various forms of basket-weave coils have attained a considerable degree of popularity lately, but you can bank on it that the product of any of the reliable manufacturers will bring in the signals provided the other parts in the receiver are right.



How Not to Build Your Receiving Set

The receiver pictured above is a typical example of what not to do if you want your set to be of "low loss" design—one that will bring in signals as clearly and as loudly as possible. Notice that the tuning coils are

placed at one end of the panel and the tuning condenser at the other, with two-stage amplifier between them. While this arrangement looks well from the front, the long leads in the secondary circuit produce distortion

accurately spaced plates making good contact with the shaft and fixed support, and rigid bearings.

The matter of bearings, by the way, is important both electrically and mechanically. We must rely on them to maintain the moving plates in permanent alignment with the stationary plates, and no condenser can be rated as first class unless the bearings have absolutely no side nor end play. Otherwise it will be impossible to be sure of always hearing the same station at the same point on the dial.

Good bearings also are of great importance in the actual operation of a receiver. A bearing that turns with a smooth, velvety motion makes close tuning possible without Vernier dials.

THE condensers made by reputable manufacturers vary somewhat as to electrical efficiency, but the differences are so small that even the poorest one of the lot still would bring in any signal that could be heard by the best one.

Nearly all tuning coils and inductances of various kinds now are labelled "low loss." And many of them are really exceptionally efficient. They are wound with the finest grade of wire, use the

will have far higher losses than the worst coil properly placed. An audio-frequency transformer produces an effect that is even worse than condenser plates when placed in the field of the coil.

If you want to know what metal does when placed in the field of a tuning coil, just hold a tobacco tin flat against the end of the coil when the set is in operation and see what happens to the signals!

AFTER all, a "low-loss" receiving set is one that brings in the signals as clearly and loudly as possible. To gain the advantages that are inherent in "low-loss" parts, the amateur builder should be willing to sacrifice appearance to have the instruments placed most efficiently.

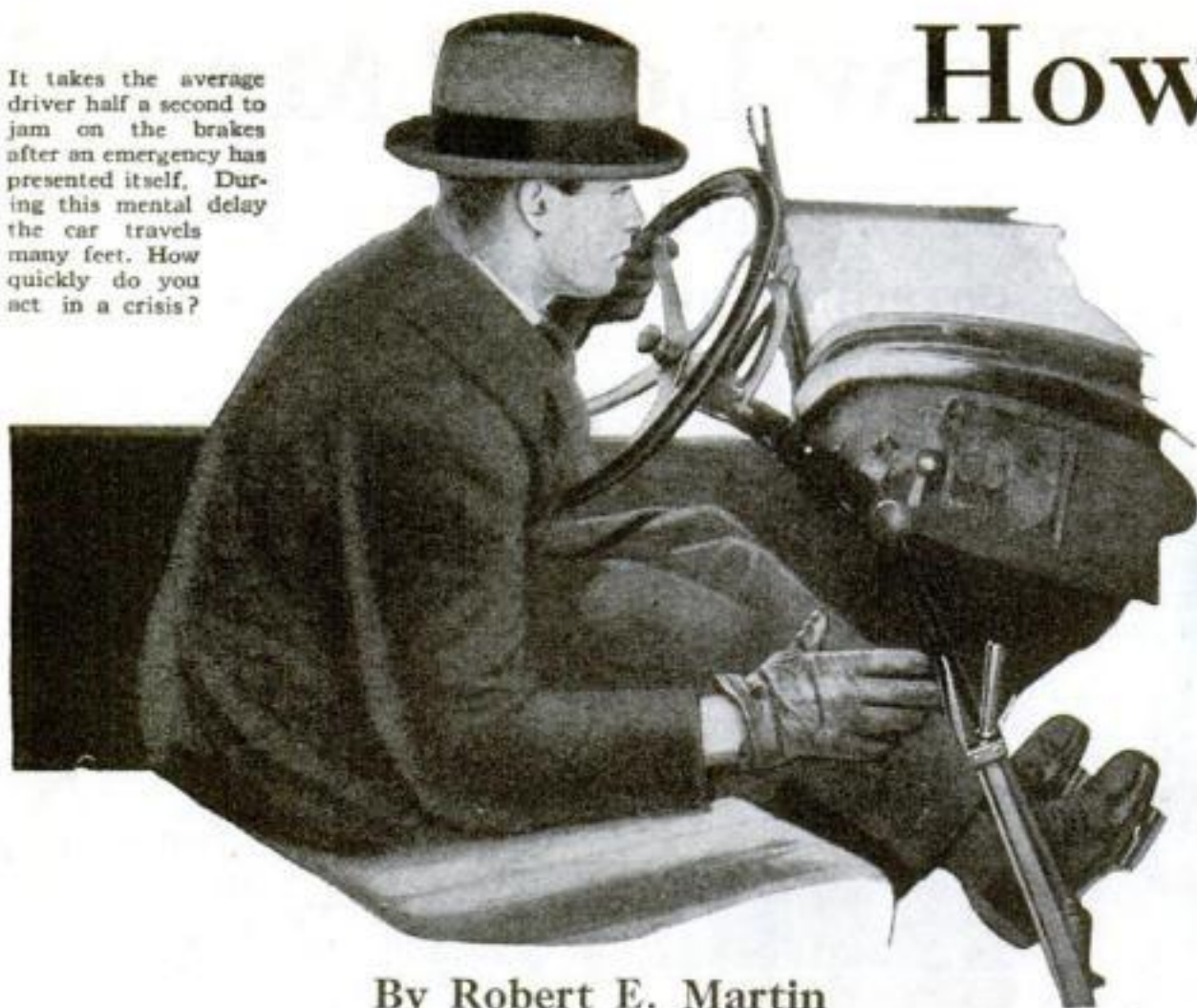
Perhaps one of the worst examples of poor design is the practice of arranging the tuning coils at one end of the panel and the tuning condenser at the other, with a two-stage amplifier located in between. Such an arrangement looks well from the front, but what can be said of the long leads in the secondary circuit? Distortion is almost sure to occur because of the capacity effect between the long connection with the grid of the detector tube and the audio-frequency wires, which often parallel it for many inches.

AND this is a very important point. You can take a really "low-loss" condenser, a correctly designed tuning unit, and sufficiently high grade parts to build a receiver, and yet if you place the parts in the set in the wrong position with relation to each other, you will lose all the value of the "low-loss" construction in the individual units.

In the first place, do not build a receiver in which the tuning coils are so placed that any large mass of metal is near the open ends of the coil. If you place a good "low-loss" coil against the condenser plates, for instance, it



It takes the average driver half a second to jam on the brakes after an emergency has presented itself. During this mental delay the car travels many feet. How quickly do you act in a crisis?



By Robert E. Martin

# How Quickly Your

## Bureau of Standards to Test Your

paralysis with which motorists are afflicted in the face of emergencies. There collisions and wrecked lamp-posts pass in constant review before the judge on the bench. There the drivers of automobiles appear at their worst—drivers whose mental alertness has been put to the test and has been found wanting.

A BALTIMORE judge recently told me of a man who was driving his car with the stream in a crowded street. A movement of cross traffic had just ceased, and the motorist moved ahead with his mind settled upon the idea that for several blocks he would enjoy uninterrupted progress before he would be stopped by the next intersecting stream of traffic. Normally this state of mind would have led him into no difficulties. But in this particular case, he encountered the unexpected in the form of fire apparatus speeding directly across his path.

There was no failure of signals and no lack of warning—a fact that was shown by the circumstance that all the cars behind this man came to an immediate stop. He was the one driver who failed. Not until he was within striking distance of a fire-engine did he attempt to apply his brakes. By this time, of course, his efforts were useless, and a bad smash resulted. Slow thinking cost the man severe injuries, a seven-passenger car, and traffic-court discipline. And there was nothing wrong with his brakes.

**S**UPPOSE you are driving an automobile at 30 miles an hour. Apparently the road is clear, when suddenly a siren shrieks and a fire-truck thunders from a side street directly into your path.

How quickly can you stop?

If your car is equipped with four-wheel brakes in perfect condition, you probably can bring your machine to a standstill within about 38 feet. And you will be borne out in this, apparently, by recognized charts of braking performance. But actually, can you? You may know that your car's braking mechanism will respond instantly to your foot on the pedal. But what about the speed of your mental machinery? How quickly, after your mind senses an emergency, can you jam on the brakes?

The answer to this question, as the result of recent discoveries by the U. S. Bureau of Standards, suddenly is revealed as a factor of tremendous importance in the appalling toll of death and injury from traffic accidents. For these discoveries, made with ingenious new measuring instruments, have demonstrated the surprising fact that for the average driver an interval of at least half a second elapses from the time he senses a warning of danger until he can jam on the brakes. And in this half-second interval of delay a car speeding at 30 miles an hour will travel a distance of 22 feet before the brakes are applied!

**I**N OTHER words, instead of being able to stop your car with four-wheel brakes within a distance of 38 feet, as you believe, the distance actually will be nearly 60 feet, if you are an average driver. And if you are below the average in quickness of mental response, the distance will be even greater.

These amazing new measurements of the mental slack in relation to safety on the road are more than substantiated in American traffic courts, where, every day, comes tragic evidence of the mental

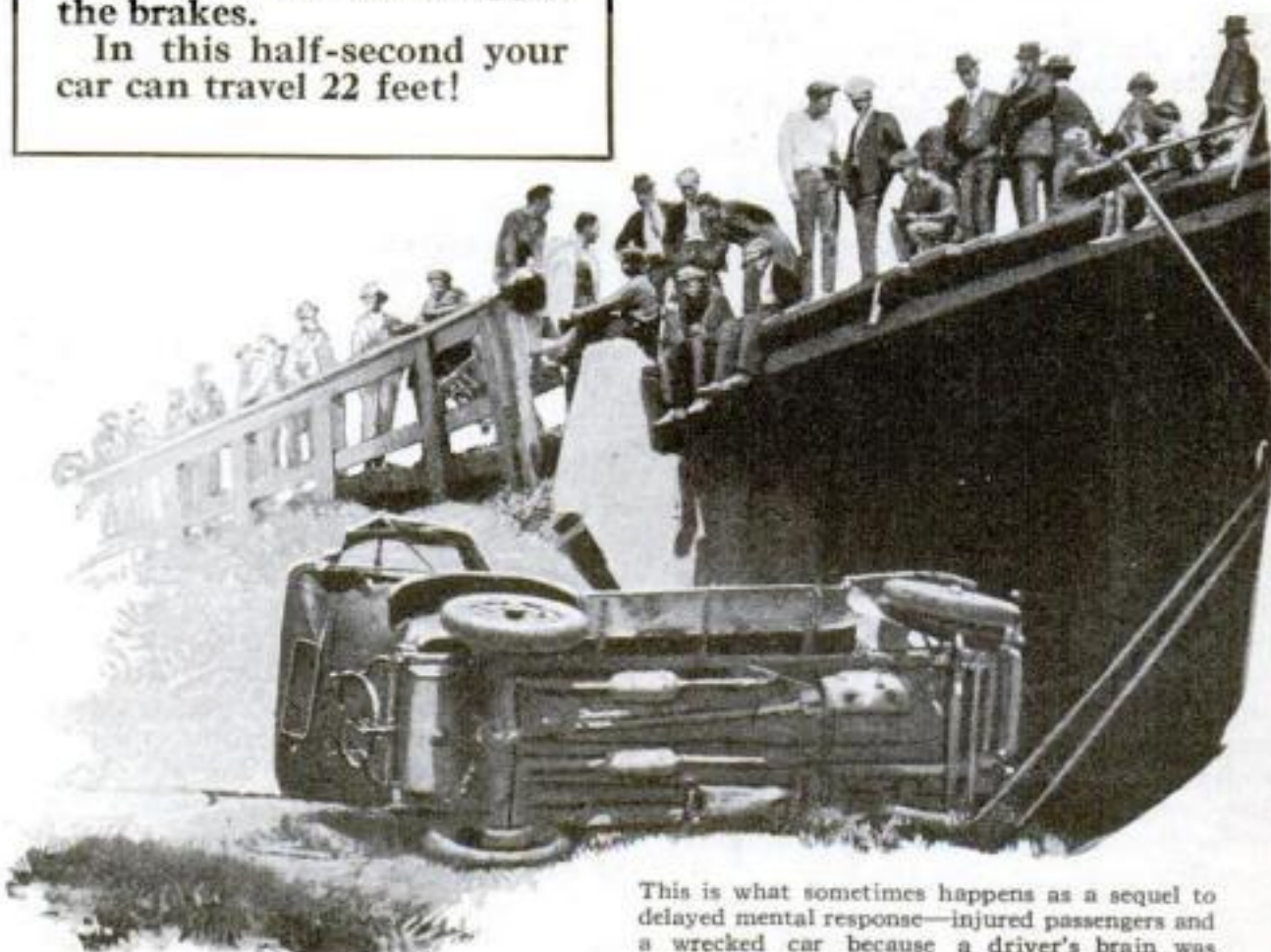
**Y**OU are driving along at, say, 30 miles an hour. A shriek from a siren! A fire-truck darts out from a side street!

How fast do you apply your brakes?

"Instantly," you answer. You are wrong.

The Bureau of Standards, investigating the "mental slack" of motorists, finds there is an interval of almost half a second between the time an emergency calls for brake action and the time most of us actually apply the brakes.

In this half-second your car can travel 22 feet!



This is what sometimes happens as a sequel to delayed mental response—injured passengers and a wrecked car because a driver's brain was half a second late in responding to an emergency!



# Can You Stop Car?

## Devises New Ways Mental Speed

Just how slowly his mind responded was clearly established by the distance between the point of collision and the spot at which full stop was reached by the car immediately behind his own. This interval of clear space measured 36 feet, proving that he had ample time to apply his brakes and halt his car if his mind had not remained frozen. His sole explanation, in court, was that he had expected a clear channel and had not "taken in" the peremptory warning of the approach of the fire apparatus.

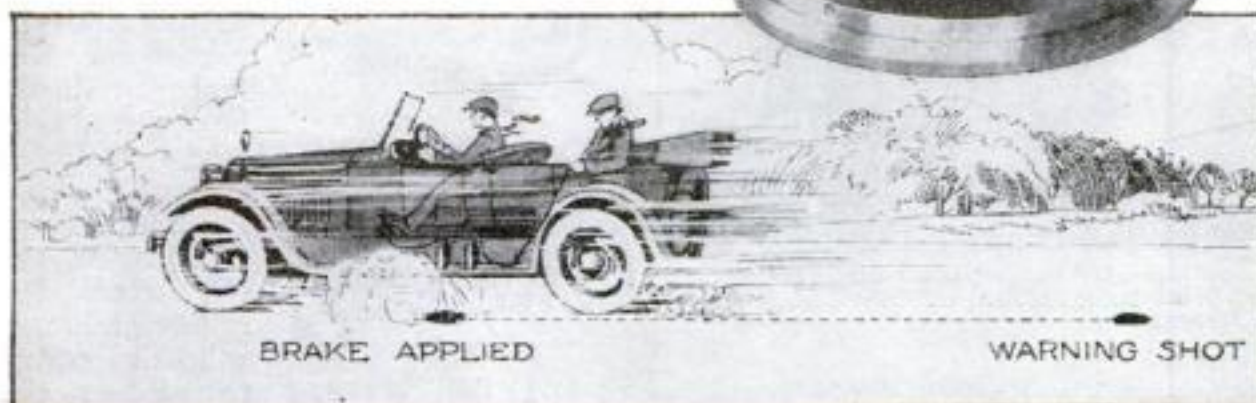
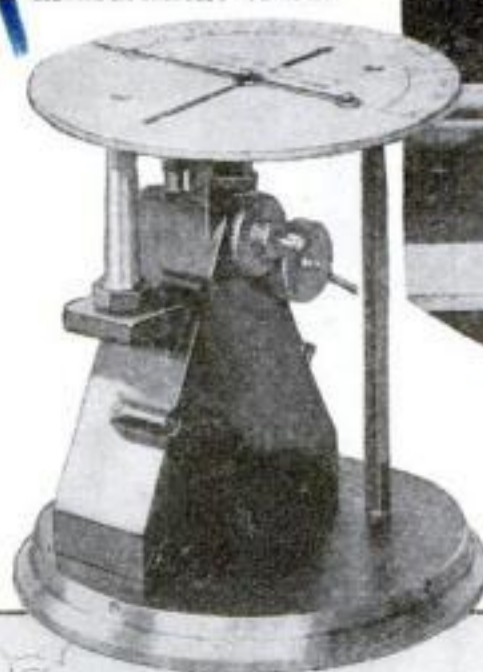
Incidents such as this might be cited without number. Again and again a valuable fraction of a second lost while the slack mind is registering an impression is sufficient to carry a car to disaster that might have been averted. Meanwhile the automobile death list grows, from more than 16,000 in 1923 to more than 18,000 in 1924.

The research of psychologists has shown that mental slack is as definite as

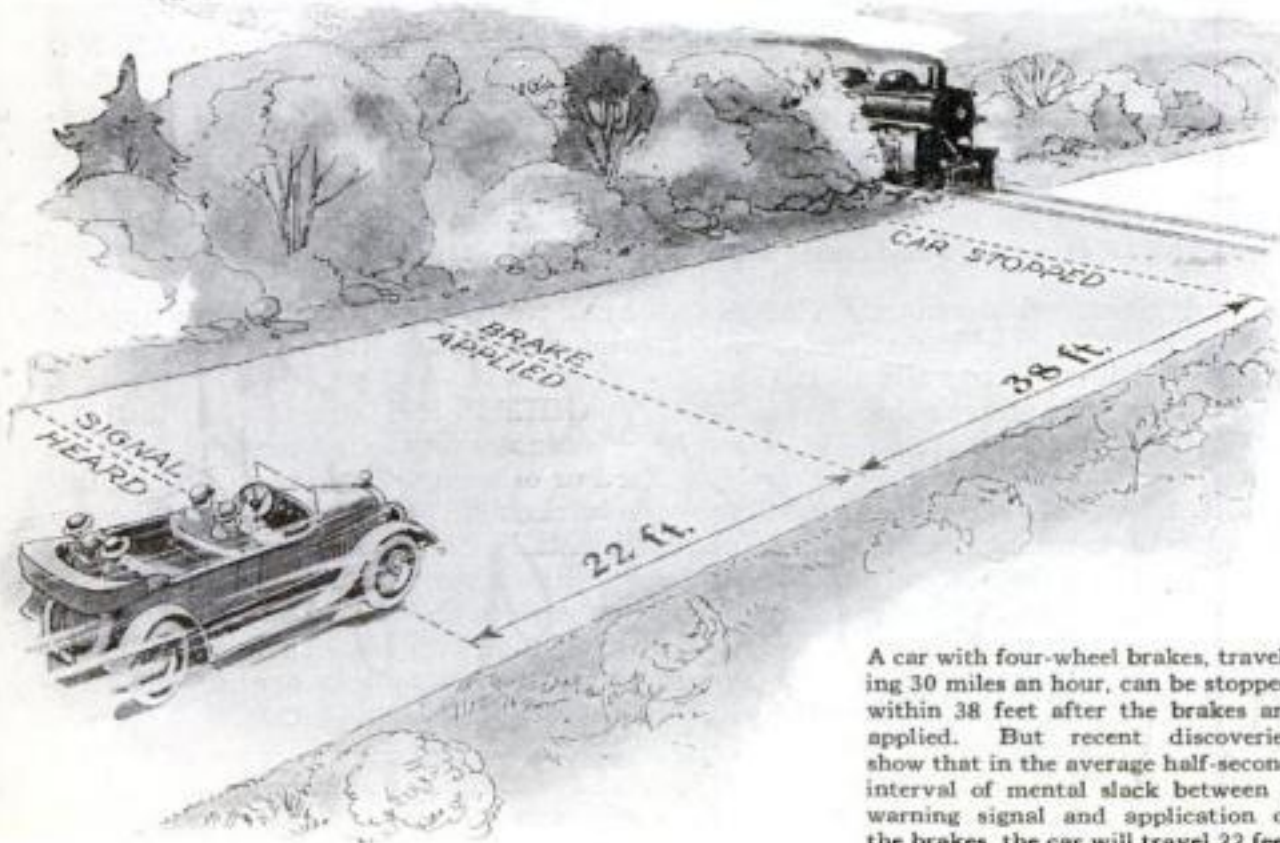
the sag in a towrope or in the couplings of a freight train. In each case there is lost motion. The captain of a tugboat knows, from experience, how far he must travel before the sag of his line is taken up. Likewise, the locomotive engineer, from his cab, can judge with equal accuracy when his train is pulling smoothly. Now science has applied actual measurement to the



An official of the U. S. Bureau of Standards making a brake test with the decelerometer, a new instrument that measures the time required to stop a car. At the left is a close-up of the instrument, without its case



The pistol test of mental delay. Bullets of red lead mark the roadway, providing a means of measuring the distance traveled between the warning shot and application of the brakes



A car with four-wheel brakes, traveling 30 miles an hour, can be stopped within 38 feet after the brakes are applied. But recent discoveries show that in the average half-second interval of mental slack between a warning signal and application of the brakes, the car will travel 22 feet

time required to take up the slack in human thought processes. In the Bureau of Standards tests, government scientists are making available to every motor-car driver valuable new measurements that will give him more intelligent control over his car and assure his greater safety.

The apparatus used in the tests employs two pistol shots fired from a moving automobile. The first pistol is fired by a judge or inspector riding behind the driver. It represents a danger signal—a peremptory command to apply the brakes. In response, the driver jams on the brakes as quickly as he can, and the pressure of his foot on the brake pedal automatically fires the second pistol.

Each bullet, fired downward from the car, is made of litharge, or red lead, which produces a red mark on the roadway. The two splotches of litharge tell the story of the driver's mental alertness or laxity, for the distance between them represents the travel of the car during the time he spent thinking about applying the brakes and in moving his foot to the pedal. In addition, the time required to bring the car to a stop and the rate of slowing down are measured by a recording decelerometer, an ingenious instrument designed especially for the purpose by engineers of the bureau.

In the Washington tests the quickest time for any driver was a quarter of a second, the slowest was six-tenths of a second, and the average was close to half a second. The best showing was hardly to be counted, for the reason that the driver had his foot on the brake pedal at the firing of the first shot. In all the other

(Continued on page 147)



# Shortcuts for Car-Owners

## Simple Light Holder

WHEN working on your car at night, you often wish you had an extra hand to hold your pocket flashlight. With the little device shown in Fig. 1 the lamp may be clamped on your head so that the beam of light is kept automatically on the spot where you are working. The flashlight is held in a clip made from strong wire fastened with four rivets to a small piece of sole leather. This in turn is riveted to a skate strap. When some inaccessible spot is to be reached with a screwdriver, the lamp may be strapped on the wrist.—F. S. Root, Fall River, Mass.



Fig. 1—Strap and wire clip hold flashlight in best position for illuminating the work

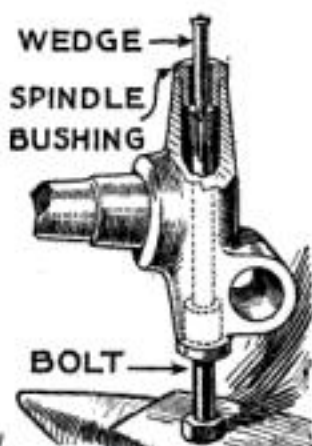


Fig. 2—Removing spindle bushings



Fig. 5—Folding pitcher

MECHANICS who park their cars outside a factory or building under construction from morning till night often find that a blanket thrown over the engine hood has been blown partly or entirely off and the engine has been chilled nearly to the freezing point. As appearances usually do not matter, it is a simple thing to use an old tire, as shown in Fig. 3; to hold the blanket over the engine. At night the tire section can be thrown into a corner of the yard for use on the next cold morning.—L. B. ROBBINS, Harwich, Mass.

ON ONE occasion when my regular tube repair kit was not large enough to repair a long blowout, I laid the tube on a piece of strap iron, placed my cement and repair rubber in position, covered it with wax paper, put a piece of tin over the

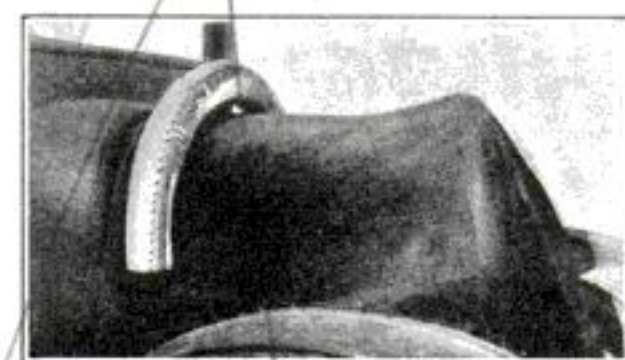


Fig. 3—Old tire prevents radiator blanket from being blown off in a high wind

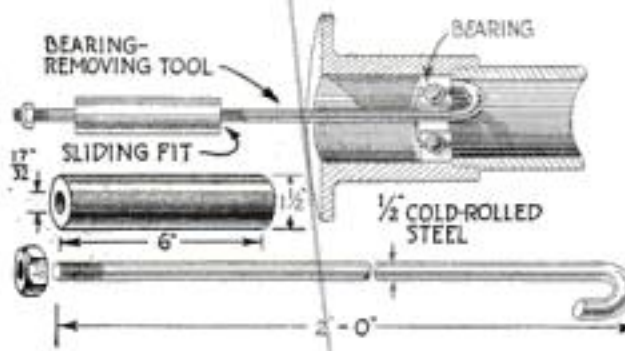


Fig. 6—Tool for extracting ball-bearing races

hole and tightened down my clamps. Then I saturated a length of sash cord in gasoline, laid it on top and lit it (Fig. 4). This made a serviceable repair.—OSCAR M. ANDERSON, Tacoma, Wash.

A COLLAPSIBLE pitcher for filling automobile radiators can be made as shown in Fig. 5 from a section of old inner tube fastened with shellac and tacks to a wooden top and bottom. Both should be an inch or more in diameter than the tube so that the rubber will have to be stretched over them. This pitcher takes up little room in the toolbox, but is exceedingly handy in an emergency when the radiator requires filling on the road.

## Speeds Night Repairs

THE auto repairman often is confronted with the problem of extracting ball races or bearings that are located inside housings and cannot be driven from the opposite side. When such parts are only a light driven fit, they can be quickly removed by the use of the tool illustrated in Fig. 6. The hook is placed behind the part to be pulled out and the sliding handle is used as a hammer.

IN AN emergency it is sometimes valuable for the owner of a Ford car to know that the nut that holds the front spring perch on the front axle will interchange with the nut holding the rear wheel on either of the rear axles. If one of the rear axle nuts becomes stripped, it will not hold the wheel. By shifting the nut from the spring perch to the rear axle, however, and placing the damaged nut on the spring perch, the car still can be used. Cotter-pins are inserted in both nuts and if the spring perch does not seem secure, it can be wired temporarily.—G. A. L.



Fig. 4—Making a long tube patch

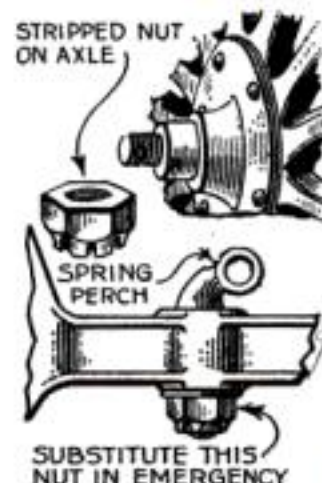


Fig. 7—Nut for axle

tar and resin melted together and applied with a brush while warm.

A CHEAP and effective method to economize gasoline consumption in a Ford or other light car is to drill and tap the intake manifold with a  $\frac{1}{8}$ -in. pipe tap and install a small whistle valve. Such a valve has a spring to keep it closed. A wire is run to the dash so it can be opened to let an extra supply of air in, especially when running smoothly over a good road on long trips.—JAMES ELLIS.

AFTER soldering an auto radiator, it is a good plan to cover the new work with banana oil or shellac to close air holes.







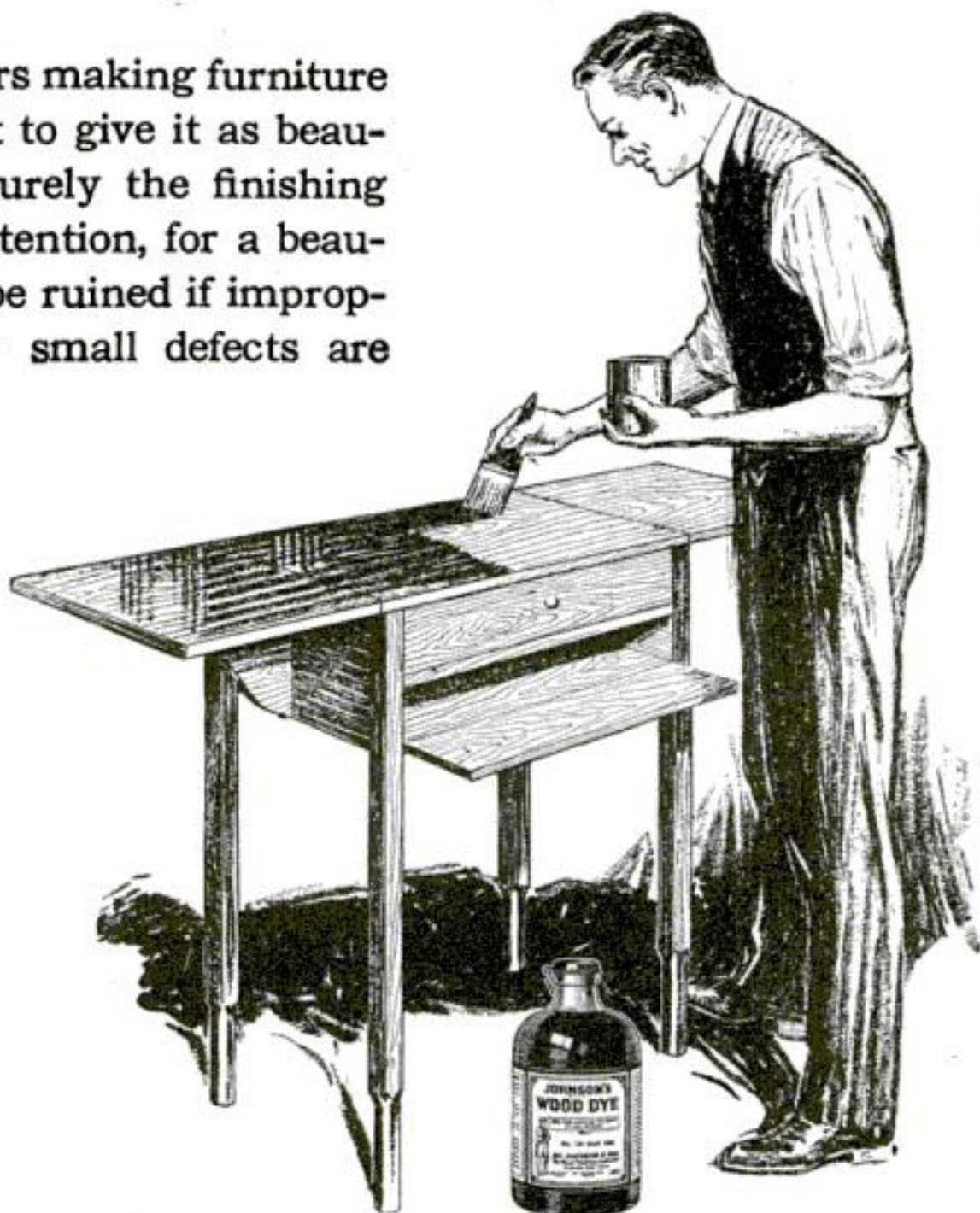




# How to Give Home-Made Furniture that Finished "Professional" Look

After spending precious hours making furniture by hand, you naturally want to give it as beautiful a finish as possible. Surely the finishing should receive its share of attention, for a beautiful piece of furniture may be ruined if improperly finished, whereas any small defects are minimized if well finished.

The Johnson Book on Wood Finishing gives complete instructions for finishing new and re-finishing old wood—soft or hard. It tells how to stain wood artistically—how to remove old paint and varnish—how to secure a beautiful enamel finish, etc. This book is the work of experts—profusely illustrated in color. It includes color charts—gives covering capacities, etc. It is full of valuable, authoritative information on Artistic Wood Finishing. The coupon below tells how to get a **FREE** copy of this authoritative manual on a fascinating subject.



## JOHNSON'S WOOD DYE

Johnson's Wood Dye is for the artistic coloring of all wood. It is very easy to apply—dries in four hours and will not rub off or smudge—penetrates deeply, bringing out the beauty of the grain.

Johnson's Wood Dye is a dye in every sense of the word. It contains no finish whatsoever. Like most first class products it answers one purpose only—it *dyes* the wood. A finish must be applied over it—we recommend Johnson's Varnishes or Johnson's Polishing Wax.

Johnson's Wood Dye is made in seventeen beautiful shades, among the most popular of which are:

- |                    |                |
|--------------------|----------------|
| 123—Dark Oak       | 131—Walnut     |
| 129—Dark Mahogany  | 126—Light Oak  |
| 127—Brown Mahogany | 124—Golden Oak |

All shades may be easily lightened, darkened or intermixed. Full directions on every label. Select the shade of Johnson's Wood Dye that you want and order it from your dealer by name and number.

### —FREE—25c BOOK ON WOOD FINISHING—



Ask for a **FREE** copy of the Johnson 25c Book on Wood Finishing at stores displaying the sign shown at right. These stores carry Johnson's Artistic Wood Finishes and will be glad to show you wood panels—and answer questions on how to properly finish wood. If no store in your locality can supply the Johnson Book—mail this coupon for a copy—Free and Postpaid.

YOUR DEALER'S NAME.....

Your Name.....

Your Address.....

City and State.....

S. C. JOHNSON & SON, Dept. P.S.4, RACINE, WIS.





# Stepping-Stones for Garden Walks

How you can build picturesque pathways about your home

**S**TEPPING-STONES made of concrete are much less expensive and much easier for the home-owner to make than a solid sidewalk. In addition, they have the advantage of a more artistic appearance for garden pathways or walks between house and garage. The fact that so many architects now specify stepping-stone walks in connection with designs for costly residences is an indication of their decorative value and growing popularity.

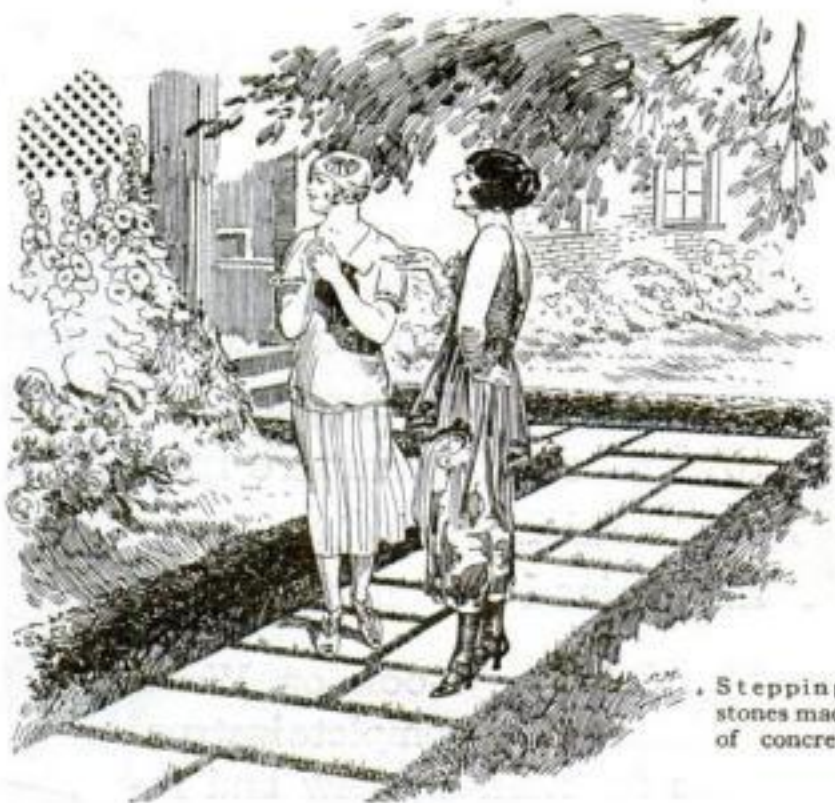
Frost will not injure this kind of a walk, for if the individual stones are lifted in the winter, they will settle back in place when spring comes.

Slabs of several sizes make a more attractive walk than if only one size is used. In the walk illustrated a pleasing pattern has been obtained with only three different sizes of slabs. The sizes

used are: 9 by 9 in., 9 by 11 in., and 11 by 22 in. These three sizes can be arranged in a large variety of combinations, with about 2 in. of sod between them.

One form for each size is sufficient to produce a considerable length of walk in the course of a few days, but if more speed is desired, two or more of each may be used.

The forms are made from pine lumber about 3 in. wide, nailed to any sort of boards, or simply nailed together and laid on smooth ground. If the forms are laid on the ground, care must be taken to



Stepping-stones made of concrete

keep the framework down by driving pegs into the earth and nailing the wood to them.

The mixture to be used for the lower part of the slabs can be one part of cement to four parts of coarse, clean gravel. Remember to mix the gravel and the cement thoroughly before adding water, and add the water in small amounts, being careful not to produce too wet a mixture.

Now oil the forms and fill them to within  $\frac{1}{2}$  or  $\frac{1}{4}$  in. of the edge with the mixture. "Tamp" it down solid and run a trowel around the edges to force the larger pieces of gravel away from the boards.

The work is now ready for the finishing coat, which is made up of two parts fine sand and one part cement. This mixture may be colored to suit the maker's taste and design by the use of Venetian red, burned umber, yellow ochre, or almost any other inexpensive color, in powdered form. This color should be mixed dry with the cement and sand before water is added. Too much color will weaken the cement.

When the surface has been smoothed with a wooden block, the sharp edges around the form can be rounded with a sidewalk edger, with a small trowel, or, in fact, with a homemade wooden tool.

The slabs are left for one or two days until the mixture "sets." They must be protected from the sun during this process and should be kept moist, particularly if the weather is hot. The forms are used again and again until a sufficient number of stones is made.

When enough slabs have been made for the walk, a sketch should be made showing the best arrangement of their positions. The simplest way to lay them is to excavate as for a continuous walk of the same width and, after the slabs are laid, put pieces of sod between the blocks.

More irregularly shaped stepping-stones can be made without forms simply by excavating holes in the ground and filling them with concrete.



Marking length of form members which are made of 3-in.-wide strips



In nailing the forms together let nails project so they can be pulled out easily when the concrete is hard



Square the form and nail it to a baseboard



Oil the forms lightly with brush or rag to prevent cement from sticking. Discarded crankcase oil may be used for this purpose, if desired



Mix the cement and gravel thoroughly before adding water, then wet the mixture and turn it over and over until uniform in consistency. This mixing-board is the back piece of a piano box

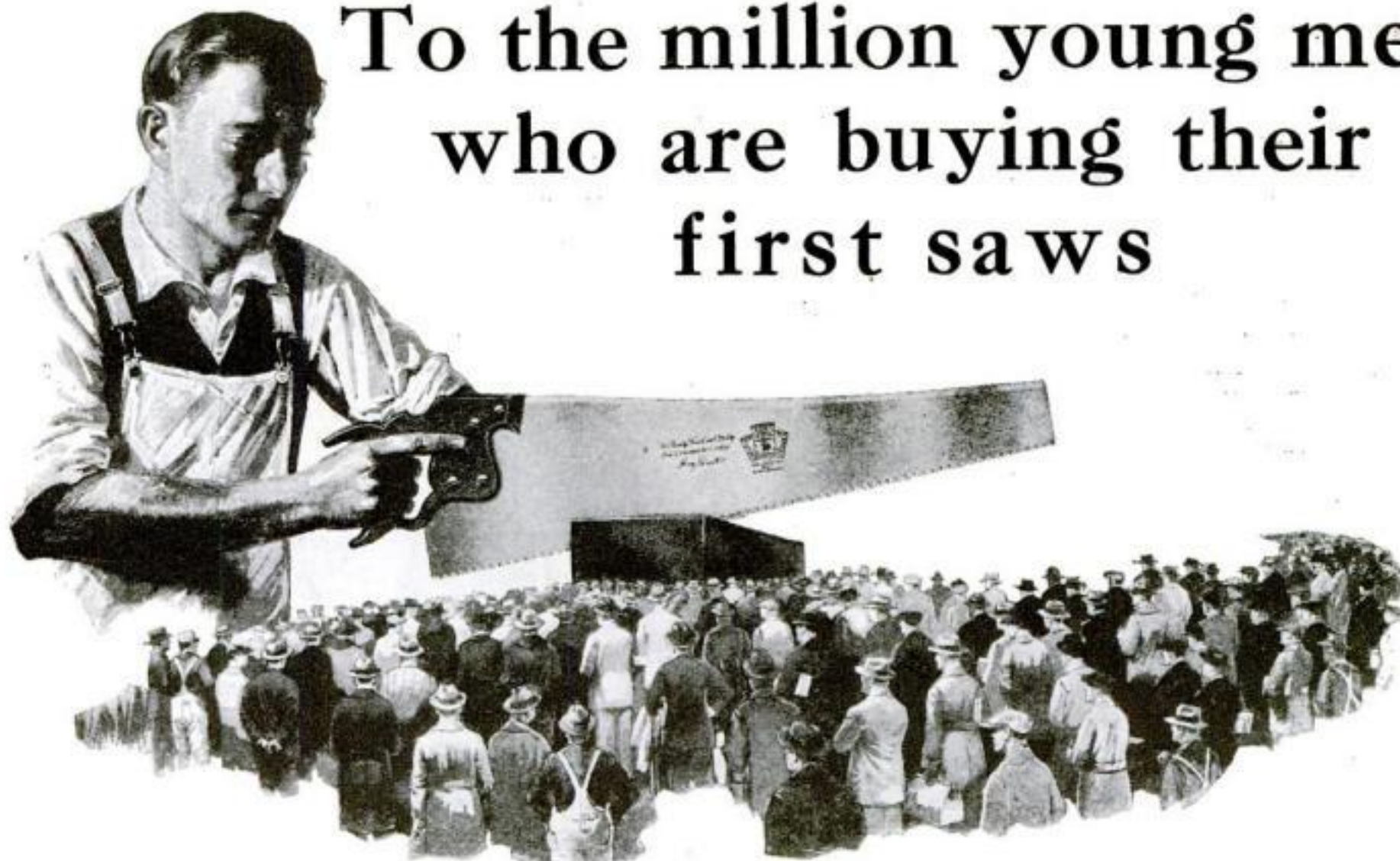


The correct consistency of the concrete is shown above. Avoid a sloppy mixture. After the forms are filled, the surface is smoothed with a wooden block, as at the left. A very smooth surface is not desirable, so do not do too much troweling





# To the million young men who are buying their first saws



*Whatever work you have to  
do, there is a Disston  
Saw to do it*



Disston Back Saw, No. 4—For accurate cutting of mitres, fine joints, or stock of small dimensions.



Disston Coping Saw, No. 10—For cutting scroll work, ornamental wood work, toys, etc. Tension of blade adjustable to each job.



Disston Nest of Saws, No. 3—Ten-inch key-hole saw, 14-inch compass saw, and 16-inch utility or pruning saw, with adjustable handle.

**Y**OUR first saw! When you choose it, you are setting a standard for the work you have to do in all the years to come.

You need not be an expert when you go to buy your saw, for the carpenter has chosen for you.

The Disston Saw, everywhere, is "The Saw Most Carpenters Use."

The Disston Hand Saw cuts true to the line. It is true itself—smithed and tensioned on the anvil by a master of the craft.

It cuts fast without binding because it is ground right for clearance. Only a Disston craftsman can taper a saw blade to work like that.

It seems "alive" when you use it, so easy is its balance. Only a Disston expert can give a saw such balance.

And your Disston Saw will hold its edge: Disston makes the steel and gives it the Disston temper!

Disston Saws, of Disston

Steel, are the most widely used saws in the world. Mechanics everywhere have learned what the name Disston on a saw means to them.

"After 20 years' use, my four Disston Saws are good for another 10 or 20 years. Some saws! The good old Disston—an honest saw for honest work."

—John J. Harris, Brattleboro, Vt.

"I am still using a Disston Saw that was my father's before me. It has been in use 65 years and is still good. I have used Disston Saws for 36 years."

—J. E. Harrison, Atlanta, Ga.

"I wouldn't lay down my Disstons for any other saws on earth, and I have been using them for more than forty years."

—L. L. Loftis, Price, Utah.

You will find the Disston Hand Saw at the nearest hardware store.

Take it in your hand. Try its spring, its easy thrust and balance. Then make that saw your own!

## Ask Disston!

Tell us what kind of work you are doing, in wood, metal, stone, ivory, rubber, leather, cloth, fibre or other material, and we will tell you what types of saws to use. Disston issues many books to aid the users of saws and tools.

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Hardware dealers the world around sell Disston Saws, Tools, and Files

# DISSTON

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# Better Shop Methods

*How Expert Mechanics Save Time and Labor*



## Cabinet Keeps Lathe Tools Handy

By Edward Kilburn

Machine-Shop Superintendent

NOTHING is more conducive to fast and accurate work than to have the proper tools within arm's reach. This is especially true in respect to lathe work, which plays such an important part in every machine-shop's output.

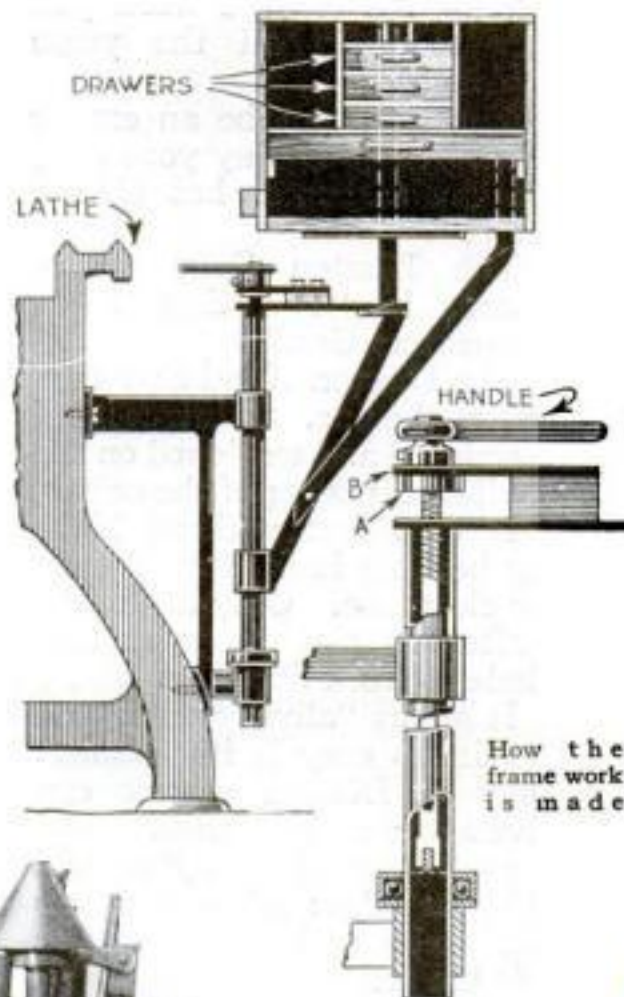
"A place for everything and everything in its place" is, indeed, a maxim particularly applicable to the machinist's trade. The great number of small tools and appliances cannot be used to best advantage if they are not handy.

The accompanying illustrations show how to provide facilities for properly taking care of all the small tools and accessories used in connection with lathe work. The rack is particularly useful where it often is necessary to remove the toolboard (if one is used) when doing full-length work on the lathe.

The tool cabinet is supported by a frame made of pipe, pipe fittings, and flat and angle steel plates, joined together by welding. The stationary portion of the frame is bolted to the back of the lathe-bed near the tailstock end. The other part is adapted to swing upon the stationary portion and carries at its upper



end a cabinet with suitable drawers for cutters and other small parts. The lower flat or table portion of the cabinet is used for lathe tools; the upper board to hold lathe centers, tailstock chuck, and the like.



How the frame work is made

The mechanism of the device is so arranged that when the cabinet is in position over the lathe-bed, it may be lowered to rest firmly on the bed. When it is desired to remove the cabinet from the bed, the cabinet is raised and swung around out of the way. A ball bearing is provided at

the lower end of the frame to make its operation easy.

The mechanical diagram shows clearly the construction of the elevating device and bearing. It will be noticed that there is a central threaded rod. At its lower end this bears on a cross bar, which rests on the top of the ball bearing. The bar is located in a slot in the central hollow portion of the swinging frame. Screwing the nut A at the top of the bar against the upper flat bar B raises the frame and with it the cabinet. Releasing the nut lowers the cabinet.

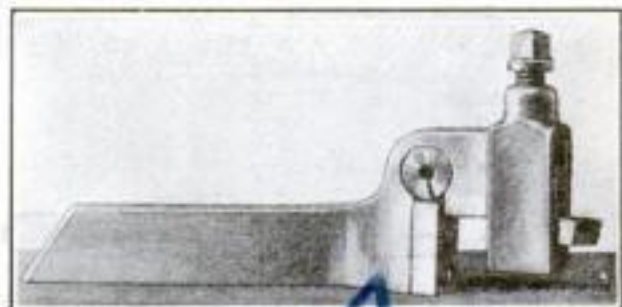
The nut A has a flange or enlarged lower portion, which bears upward against the bar B.

The main or upper part of the nut, which passes through B, is fitted with a handle.

This device is much more convenient than a stationary cabinet, which must be removed to the floor when long work is placed in the lathe. As soon as it is on the floor, a cabinet becomes nothing more than a stumbling block for every passer-by, and the chances of tools being lost or damaged are greatly increased.

### Spring Threading Tool

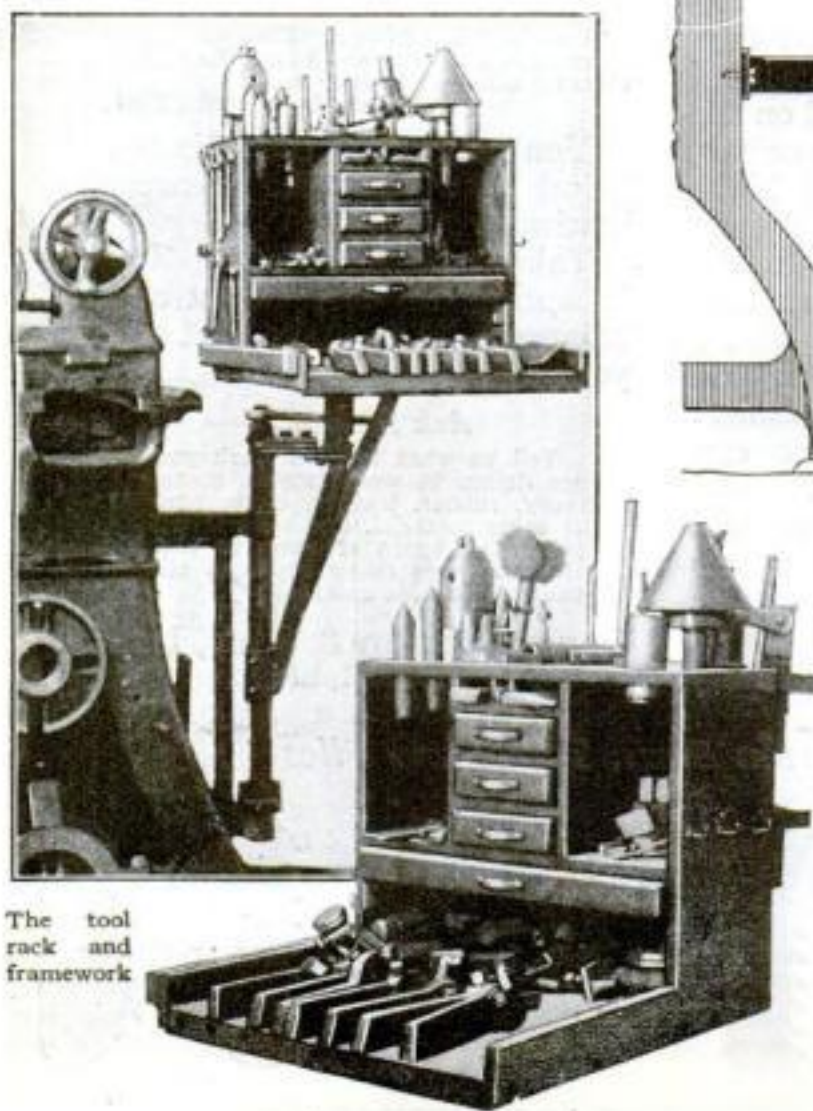
TO OVERCOME the shortcomings of certain commercial spring threading tools, which have no provision to prevent them from springing sideways or parallel



with the axis of the screw being cut, the tool illustrated was devised. It is prevented from springing sideways by the plate, B, shown directly beneath the spring bushing. This is keyed and screwed to the shank, A, and has a slot in its top edge that engages a keylike extension or lug, C.

Bushings are inserted as desired, to increase or decrease the spring of the tool.—CHARLES KUGLER, Philadelphia, Pa.

DON'T fail to turn to pages 126-136, where you will find the continuation of the Better Shop Methods Department.



The tool rack and framework



*Why do the  
Crack Machinists  
Advise  
the Apprentice  
to start with  
Starrett Tools*



## Apprentice Set No. 901

You'll use the Starrett Tools you buy today for the rest of your life. Ten years seems like a reasonable length of service for a Precision Tool, yet any veteran machinist will show you Starrett Tools which he has used twice and three times ten years. It's all in the way Starrett Tools are made. Parts are correctly proportioned. The finest steel the market affords goes into

these lifetime tools. The workmanship is unexcelled—a characteristic which is obvious when you examine a Starrett Tool—and is always evident in its lasting accuracy.

Starrett Apprentice Sets (Nos. 900 and 901) give you the tools you need to start—and tools you'll always need. Sold by first-class hardware stores everywhere at a price you can afford to pay.

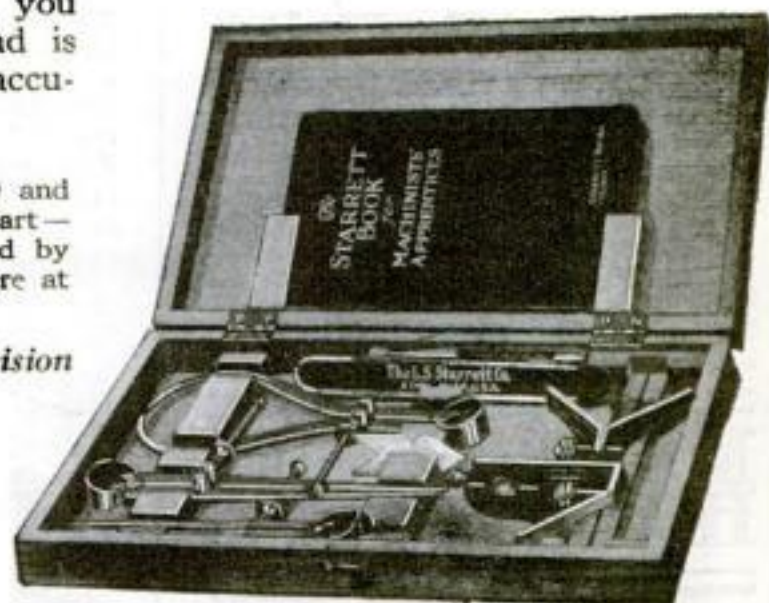
Write for Starrett Catalog No. 23 "W" describing the uses of 2200 Fine Precision Tools FREE.

### THE L. S. STARRETT CO.

*World's Greatest Toolmakers*

*Manufacturers of Hacksaws Unexcelled  
Starrett Tapes—Standard for Accuracy*

ATHOL, Mass.



The Starrett Set for Apprentices and Students comprises the following Precision Tools neatly cased in a substantial and nicely finished wood tool box: 6-inch Combination Square No. 11 complete, 6-inch Flexible Steel Rule in Pocket Case No. 320, Center Punch No. 117-B, Center Gage No. 390, 5-inch Divider with Spring Nut No. 77, 6-inch Outside Caliper with Solid Nut No. 79, 6-inch Inside Caliper with Solid Nut No. 73. And the Starrett Book for Machinists' Apprentices (Vol. I), 184 pages that show "how to do it."





## Look for "D. MAYDOLE" on the head

IT'S definite assurance that the hammer with the looks and perfect "hang" has in addition a quality and toughness that makes it good for years of hard service.

Most experienced tool users can tell a Maydole Hammer even without looking at the name. It has a distinctive character that has been developed and enhanced throughout the 82 years devoted by its makers to perfecting the hammer. Pick up a Maydole and you'll find it has a "hang" unlike any other hammer—most carpenters, machinists and other mechanics like it better.



Maydole Ball Pein Automobile Hammer  
Head is of pressed steel, tempered separately at each end for the particular work it is to perform. Handle is of clear, second-growth hickory, air dried for years.

Ask your hardware dealer to show you a carpenter's, machinist's or other type of Maydole Hammer. You'll see the difference.

Write for useful pocket handbook 23 "B." It's free.

# Maydole Hammers



The David Maydole Hammer Co.  
Norwich, New York

7050

# The Home Workshop

## How to Plane a Board Accurately

*Expert Shows You His Own Methods*

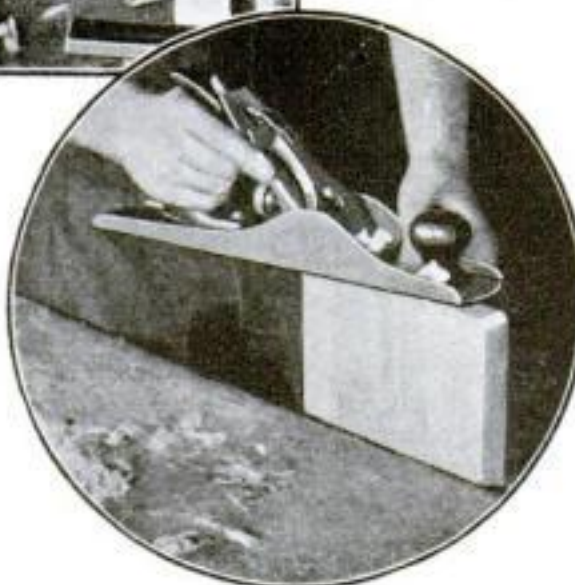
By Emanuel E. Ericson, *Noted Manual Training Authority*



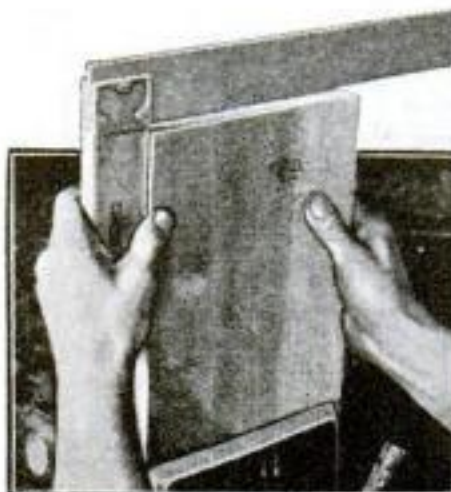
Surface planing with strokes made the whole length of the board, if possible (above). If board is wide, "cross plane" it first; then start at one edge, letting each shaving partly overlap the previous one until the whole surface is covered. Repeat, working back to the first edge



Testing the surface with edge of plane against the light (above). Also test from corner to corner to detect twist or "wind." If board is large, this is done on the bench, using a straight edge, if plane is not long enough



Planing end (at left) after one broad surface and one long edge have been planed. The long planed edge is toward the worker. Note that one corner is chiseled off to prevent wood from splitting



Testing with square (at left). The end must be tested both from the broad surface and the long edge. Hold handle firmly against surface and let square down slowly. The last plane stroke must be right across



Gaging for thickness (above). Hold the gage firmly against the wood and tilt bar forward. Mark both ends and edges. When planing put rough end against the bench stop

Marking to length (at right). Lay rule on surface, locate knife at correct point, then move square up against knife. For accurate work, draw lines all around the board

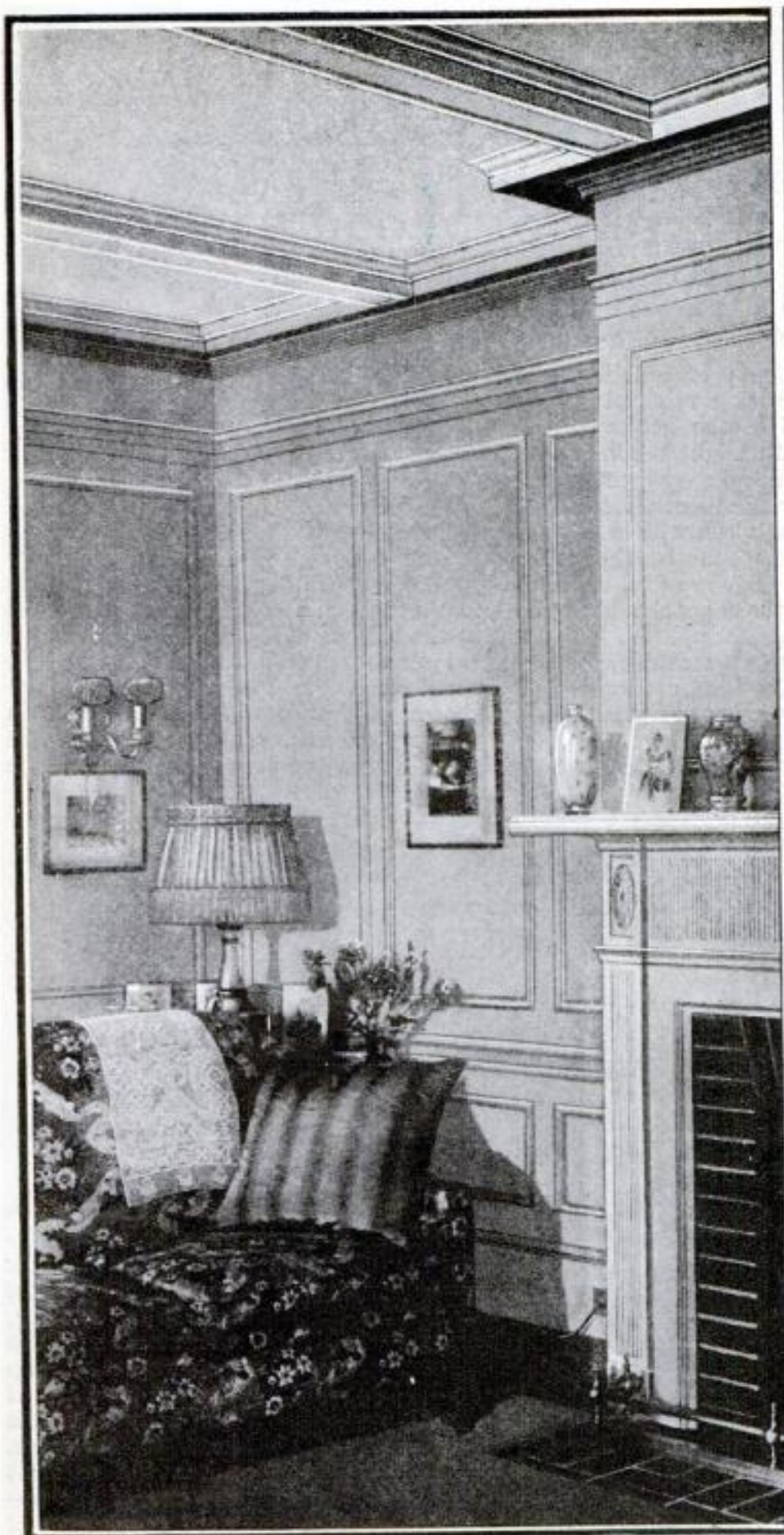


Sawing board 1/16 in. beyond knife line to allow for truing the end with the plane by the method previously used



Marking to width when a board is too wide for the gage. When the edge is planed, the chiseled corners disappear





IN THE attractive living room above, Upson Board has permanently renewed shabby walls and ceilings.

And aside from its use for walls and ceilings, Upson Board has 100 uses around the home. Its easy workability makes it ideal for making wardrobes, photographic dark rooms, cabinets, doll houses, wastebaskets, lapboards, tables, toys and countless other useful articles.

It will pay you to keep a few panels in your home workshop. Mail the coupon for samples and details!

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427 Upson Point, Lockport, N. Y.

☐ Check here and mail with 5c if you want Upson samples and literature.

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What kind of room?.....  
New or remodeling?.....

NAME .....

ADDRESS .....

# At last- a wall that successfully resists heat-cold jars-moisture-time

IN NINE out of ten homes, investigation shows at least one cracked, shabby plaster wall or ceiling!

Now there is a sure, quick, easy way to transform such a room. *Upsonize!* Apply big, sturdy panels of Upson Board right over the old plaster—in new construction, direct to studs. Then, appropriate wood trim, a coat or two of paint—and your room is finished.

Upson Self-Clinching Fasteners, a patented and exclusive Upson innovation, eliminate ugly nail marks—the big objection to ordinary wallboards—by anchoring Upson Board securely from the back.

## The nearest-perfect wall material!

Conclusive tests have proved the superiority of Upson Board. In one of many dramatic tests for strength, made by impartial engineering laboratories,



weights were dropped from several heights upon specimens of different wall materials. Upson Board withstood an impact of 40% to 70% more than the other fibre wallboards tested, and nearly 150% more than plaster-filled boards twice as thick. Jars and blows that

would ruin ordinary plaster walls have little or no effect on Upson Board.

In another impressive test, Upson Board immersed in water for a given length of time gained only 1/2 ounce to the square foot. Gypsum-filled board exposed to the same test increased nearly 1/2 pound to the square foot. Other wallboards were found to absorb nearly twice as much water as Upson Board. The ordinary leak has little or no effect on Upson Board.



## A wonderful new plan service!

Ask your lumber dealer to see the amazing new Upson Blue Book—the most complete plan service ever offered for renewing and beautifying walls and ceilings. If he hasn't it, send us his name and 25c, and we will mail you full-size blue print with complete directions for Upsonizing any room. (State kind of room and whether new construction or remodeling.)



THE UPSON COMPANY  
427 Upson Point Lockport, N. Y.

# UPSON PROCESSED BOARD

Genuine Upson Board has the famous Blue Center

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# The Wheel's the thing

THE new Millers Falls glass cutter wheels cut as steel wheels never cut before. They are hard, sharp, uniform; the edges last. They are right.

We've been making glass cutters for 45 years. With all that experience, we put in more than a year of intensive plugging to develop our improved wheels. The wheel has always been the weak spot. We tried many steel alloys, different heat treatments. Each new lot of wheels was tested rigorously.

Now we say they're right, because we have proved it to ourselves. The Millers Falls name on them proves our confidence to you.

## This is No. 7 Improved—

single wheel; easy grip handle, enameled red.

## This is No. 300 Improved—

six perfect wheels in turret flush with frame. Wheels protected from injury by patented feature of cutting arbor integral with turret. Easy grip handle, enameled hardwood.

## Millers Falls Improved Glass Cutters

with the new long-life, fine-cutting wheels. Special alloy steel wheels; hardened by special process; uniform; lasting. They make a deep, clean cut. Eight styles.

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Millers Falls, Mass.

28 Warren St. New York 9 So. Clinton St. Chicago

Manufacturers of Mechanics' Tools, Hack Saws and Automobile Tools

**MILLERS FALLS TOOLS**

SINCE 1868

# The Home Workshop

## Ingenious New Bunny Toys Made Entirely of Wood

By Charles M. Miller

Asst. Supervisor of Manual Training,  
Los Angeles City Schools

MANY methods of building new and interesting rabbit toys are suggested in the accompanying illustrations. With slight modifications some of the mechanical movements could be used effectively on other animal forms.

The edges of toys cut with a coping-saw, such as these rabbits, should be square. Whether they are filed or sand-papered, or both, the edges should not be rounded, as is often done.

The back legs, when movable, operate in unison. Usually they are connected below the body by means of a small dowel through both feet.

Among the many mechanical movements possible, that of the rabbit shown in the photograph is perhaps the simplest. The form is  $\frac{1}{2}$ -in. thick wood. The front wheels are glued to a  $\frac{1}{4}$ -in. dowel that passes through a  $\frac{5}{16}$ -in. hole in the front feet. Small button molds are slipped up close, but not too tightly, against the sides of the feet to pre-



proved by painting it with characteristic markings, some of which are suggested at the bottom of the page.

Four movements a little more complicated than the Peter Rabbit toy are shown in the drawings of Fig. 2. In the first one, the rabbit raises his front feet through the action of a cam on the

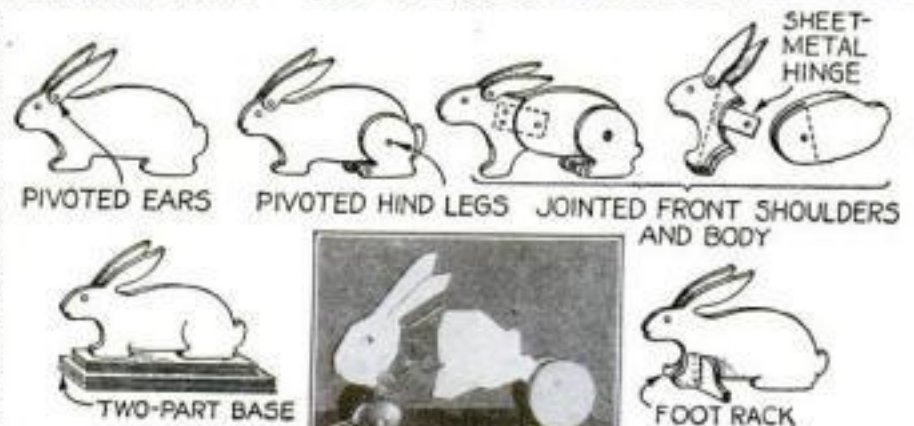


Fig. 1. Simple rabbit toys cut out with a coping-saw

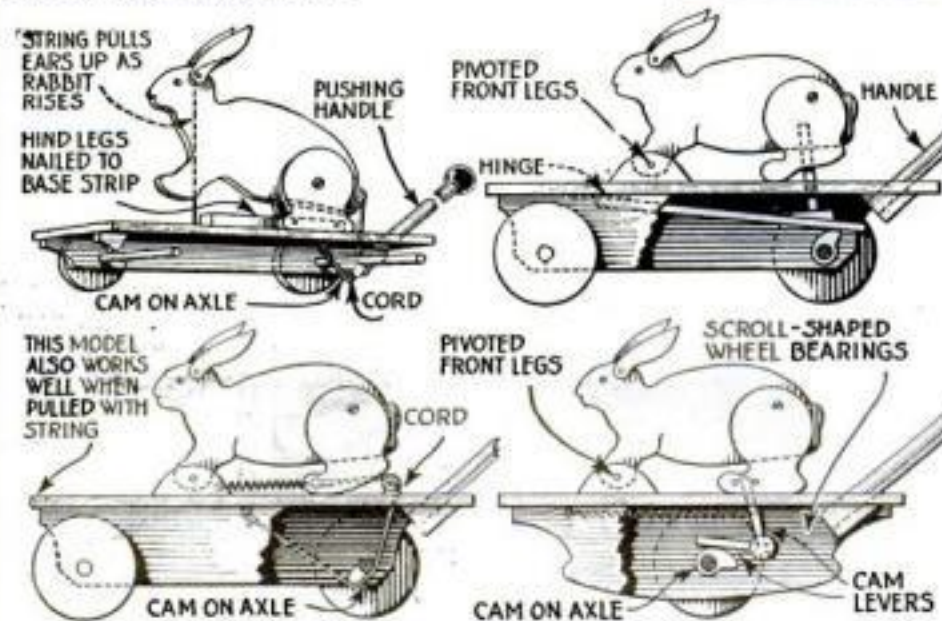


Fig. 2. Four methods of giving a toy bunny a lifelike hopping motion as it either is pushed by a handle or pulled along the sidewalk

vent the axle from slipping from side to side. The rear axle is the same except that the wheels are larger, in this case 3 in. in diameter, and closer together. The rear wheels are fastened to the axle about  $\frac{3}{4}$  in. off center; this gives a jumping motion (Fig. 1).

Peter Rabbit in this particular toy has a red coat with a black collar. The appearance of any rabbit toy can be im-

proved by painting it with characteristic markings, some of which are suggested at the bottom of the page. Four movements a little more complicated than the Peter Rabbit toy are shown in the drawings of Fig. 2. In the first one, the rabbit raises his front feet through the action of a cam on the rear axle, which pulls a string attached to the tail. At the same time another string, which runs from the base board up through the front of the body and the head to the ears, raises the ears at the end of the upward movement of the body.

Shown at the right of this is a method for making a bunny hop. A wooden cam glued on the rear axle moves up a hinged board that in turn pushes up the hind feet. A third method provides for raising the hind legs with a string and cam and pulling them back with a spring. This toy operates well when pulled; the others are more certain in their action when pushed. In the fourth example the cam's motion is transmitted through two levers mounted on a shaft.







## Save Your Knuckles

**G**O OVER every bolt and nut, from motor to rear end, with an ever-useful set of Blackhawk "Q.D.'s." There's a socket to fit every job, without ever slipping off—and a handle to give you just the right reach and leverage.

Whatever make or model of car you drive, your dealer can supply you with a selected "Q.D." set—especially designed by Blackhawk engineering for your particular car.

Extra husky handles with comfortable grips and sturdy broached sockets—exactly 1/64" oversize—tougher than any nut they will ever meet. You will like the rich, durable, all-black finish that's baked on.

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Made and Guaranteed by  
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Dept. L, Milwaukee, Wis.

(Also manufacturers of  
Blackhawk Water  
Pumps for Fords)

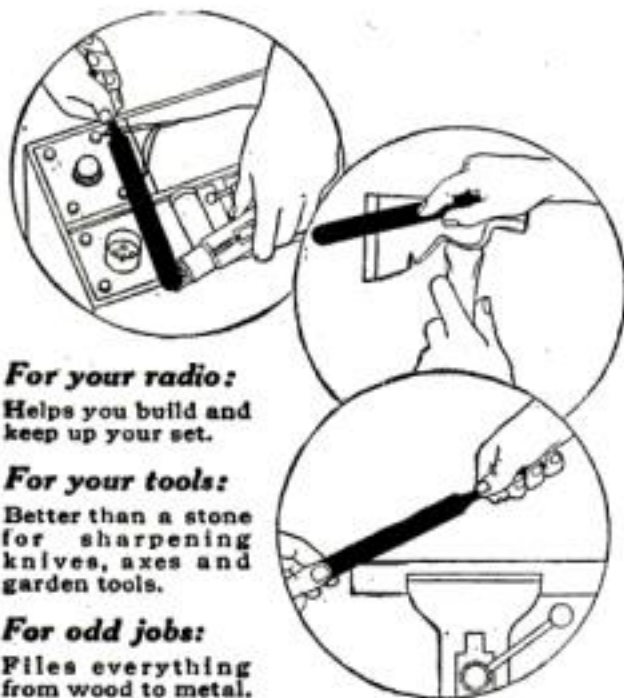
When you see a  
"Hex" think of  
BLACKHAWK!



# BLACKHAWK

## Welded Wrenches





**For your radio:**  
Helps you build and keep up your set.

**For your tools:**  
Better than a stone for sharpening knives, axes and garden tools.

**For odd jobs:**  
Files everything from wood to metal.

## With this file you can do any job

ANY man who likes to work with tools needs this new and better file—The Plumb All-Work File.

The handle, forged as part of the file, fits your hand, gives you perfect control of the stroke and makes filing easy.

No handle to buy—no handle to lose—no handle to turn in your hand and ruin your work and temper.

The sheath protects the teeth from rust or injury, fits your pocket and is fine for your tool box.

File is 10 inches long,  $\frac{3}{8}$  inch wide—just the size that is most useful.

**PLUMB**  
DOUBLE-LIFE

## All-Work\* File with sheath

(\*Trade Mark Reg. U. S. Patent Office)

It has two faces; double cut (coarse) on one side for fast work, single cut (fine) on other side for a smooth finish.

Two files in one, with forged handle and sheath.

For your pocket, your tool kit, your shop and your car.

**35¢** at your dealer's or by mail  
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Don't put off getting this file, just the one you need for every kind of work.

The better hardware merchants now have the Plumb All-Work File. It's a pleasure to supply you if your dealer can't. Just send the price (stamps will do) and the All-Work File will come to you by the next mail.

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**PLUMB**  
DOUBLE LIFE

Hammers Hatchets  
Files Sledges Axes

# The Home Workshop

## Building Motor-Trucks for a Model Railway

By Edward E. de Lancey

THIS is the second of a noteworthy series of articles on simplified railroad model-making. It explains the general principles of constructing motor-trucks for the beginner whose tool equipment is limited.

THE accompanying illustrations show the construction of a motor-truck. They indicate the method of mounting the motor, the gearing, the swing plate, shoes, and other essential details.

The trailer truck is a duplicate of the motor-truck, but without motor or gearing. However, it must have its own pick-up shoe and perhaps a separate return current brush on one axle.

You will have to buy the following supplies:

1 pr. bevel gears, 16 and 48 teeth respectively. The larger gear usually takes a  $\frac{1}{4}$ -in. axle. For the smaller one, ascertain the diameter of the armature shaft with a drill gage and use the indicated size of drill for re-boring.

2 sprocket wheels with 12 in. of "ladder" type sprocket chain to fit.

4 pr. 2-in. wheels (preferably with spokes), fitted to axles to a  $2\frac{3}{4}$ -in. gage, and having journals projecting  $\frac{5}{16}$  in. beyond the faces of the wheel bosses. Have the flanges rounded inside and out and the treads polished.

(Continued on page 101)



Views showing general arrangement of motor-truck parts. Compare with the simplified construction shown below

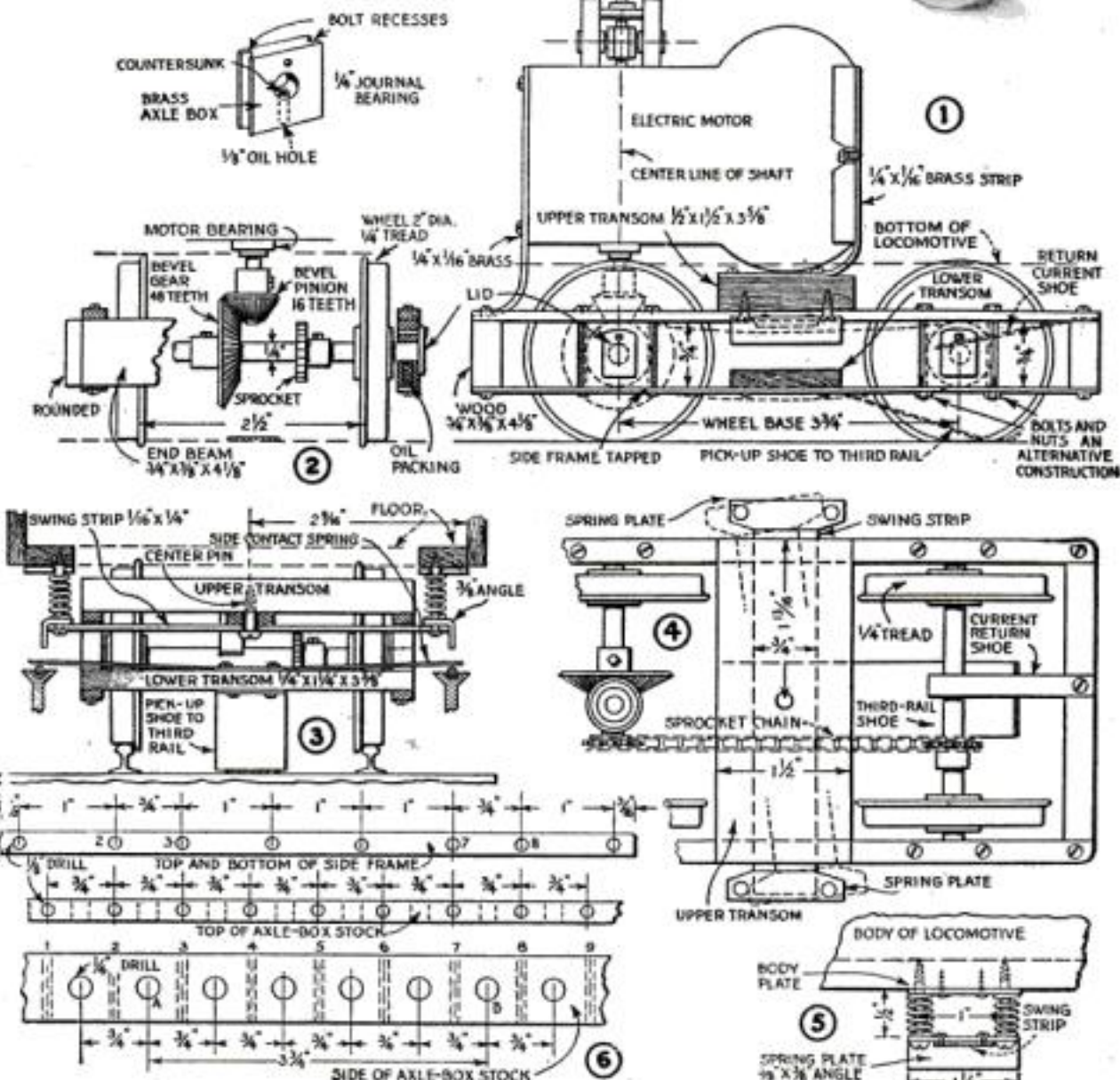
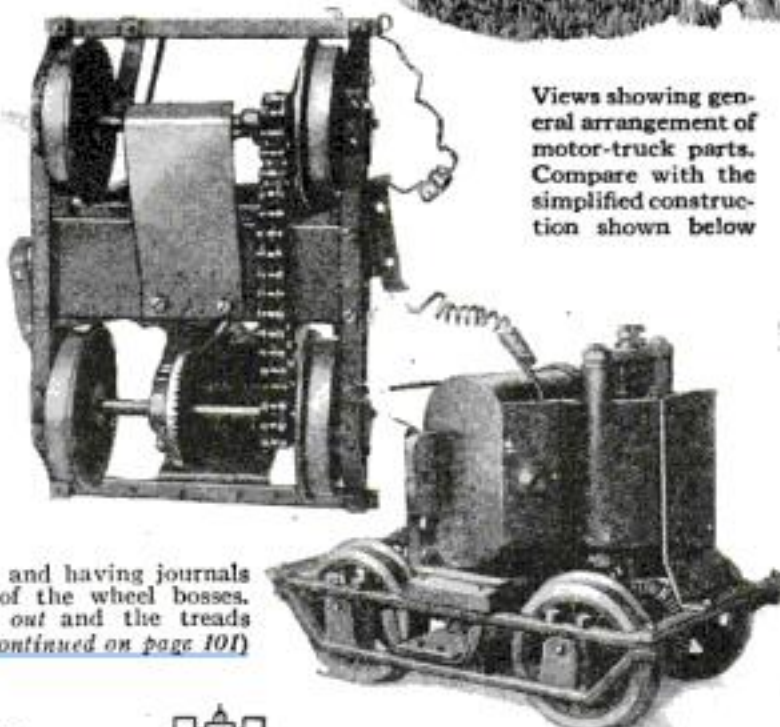


Fig. 1—Side elevation of the motor-truck. Fig. 2—Bevel gearing, sprocket, and section through the journal box. Fig. 3—End view. Fig. 4—Part plan view. Fig. 5—Detail of spring plate and springs. Fig. 6—Method of laying out brass boxes and side frames



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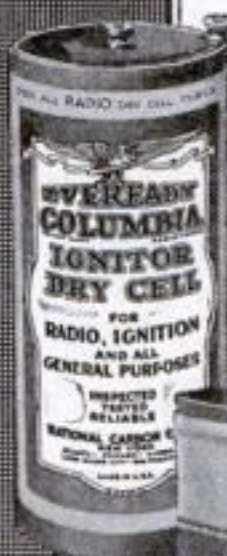
San Francisco

Canadian National Carbon Co., Limited, Toronto, Ontario

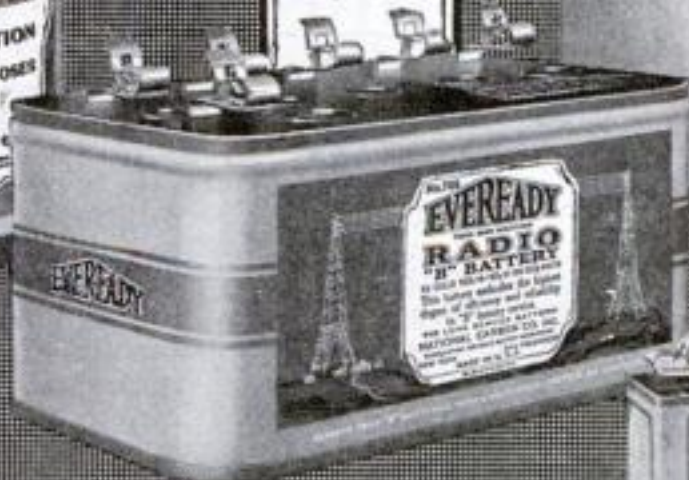
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\$2.00

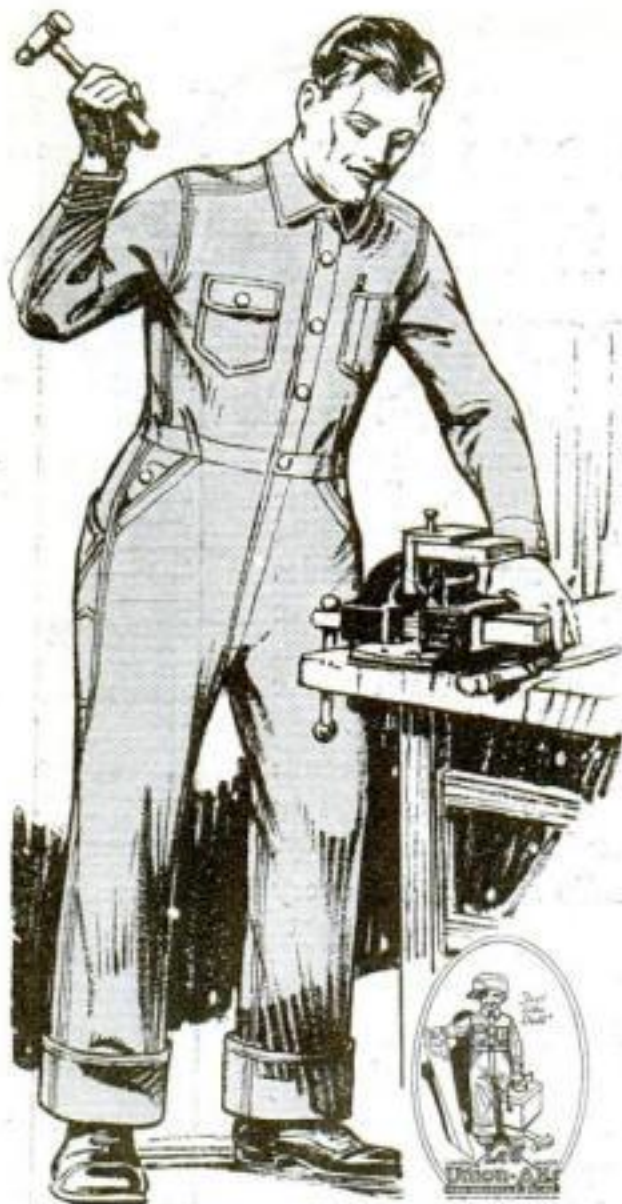


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No. 771  
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FOR the man or boy who has a home workshop, Lee Union-Alls are a handy "tool" to have about. All that is necessary when you want to get busy is to slip into them and start your work. They cover the body from head to foot and can be worn over other clothing. They save clothes, also. And they save time where the hours for such work are limited.

Wear Lee Union-Alls, the original one-piece work suit, worn by thousands of mechanics, shopmen, garage workers and industrial workers. Lee Union-Alls are quality-built—close-woven cotton fabric, riveted rustproof buttons, reinforced strain points—fully guaranteed to give satisfaction. They give solid comfort, long wear, and are neat in appearance. Accept no substitute—look for Lee on the buttons. Thousands of live dealers sell Lee Union-Alls. Ask your dealer today!

# Lee Union-Alls

THE H. D. LEE MERCANTILE CO.  
Kansas City, Mo.

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Lee Overalls and Work Shirts are other items in the famous Lee line. They are quality-built, also.

# The Home Workshop

## How to Re-Cane Your Old Chairs

The use of machine-woven cane—Steps in weaving the strands by hand

IN YOUR attic or basement there are probably one or more chairs that have been discarded because the caning of bottom or back has been broken. To put chairs like this into use again is not nearly the difficult task that you might imagine. You can repair such chairs and at the same time spend several pleasant hours in your own workshop, or even in the kitchen.

If the chair originally had machine-woven cane, you will notice that all the edges of the cane are held in place by a strip of reed or splines embedded flush in a groove. If the chair is round, first locate the end of this reed. Force a narrow chisel or a small sharp screwdriver between the ends of the spline and start lifting it out of its groove. Place a small flat block as a fulcrum between the chisel and the chair rail or frame and gradually pry up the spline. Square seats usually have four splines mitered at the corners. Clean out the groove with the chisel followed by a little hot water applied with an old toothbrush.

IF THE chair needs refinishing, attend to it now. At least the chair should be washed thoroughly with soap and water to which has been added a little ammonia. Machine woven cane from 10 to 18 in. wide may be purchased by the lineal foot at almost any upholsterer's supply house, and some local furniture dealers carry it in stock. Your piece should be about 2 or 3 in. larger all the way around than the opening in the chair. Both the open and the closed mesh, or matting, may be bought at about the same price.

If you have broken or split the reed spline while removing it from its groove, buy a new one. The size is standard and it comes in lengths of from 8 to 12 ft. Cut off a piece several inches longer than the total length required for your chair

By William T. Weld  
Shopwork Instructor,  
Central High School, Peoria, Ill.

and plane or scrape the sides of it until it makes a fairly tight fit in the groove.

Now make three or four wooden wedges for holding the cane in place temporarily. They should be from  $\frac{1}{2}$  to 2 in. wide, 6 in. long and tapering from  $\frac{3}{16}$  to  $\frac{1}{2}$  in. Hot cabinet glue is best for gluing in the spline, but a small can of first-class liquid glue placed in hot water until it is quite thin will serve nicely.

Now for the caning itself. Soak the cane in lukewarm water for two or three minutes to soften the fibers a little. Meanwhile pour or spread the glue in the groove and along its sides, using a thin, narrow stick or a small brush.

PLACE the moistened cane over the chair opening with the smooth or glossy side uppermost. Arrange the strands exactly parallel with the front and rear edges of the opening. Let the surplus material extend equally around all four sides.

Beginning at the back, drive in one wedge, forcing the cane down into the groove. Do the same at the center of the front rail, being careful to keep the strands of the cane parallel to the front and rear rails. Repeat at the sides.

With a larger wedge or a caulking iron drive the cane tightly into the groove all the way around. If there are any rounded corners, do these last with a narrow wedge. Your cane is now in place, but the outer edges stick up beyond the surface of the seat. Take a sharp chisel or a heavy knife and, working from the inside, cut off the surplus about  $\frac{1}{16}$  in. below the surface of the seat. Take great care not to injure the wood.

Some workmen prefer to drive the spline into place first and trim off the edges of the cane by cutting carefully against the spline just before it is driven in tightly flush with the seat rails.

Remove each wedge as you encounter

(Continued on page 117)



A seat that requires machine-woven cane

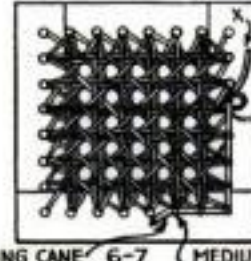
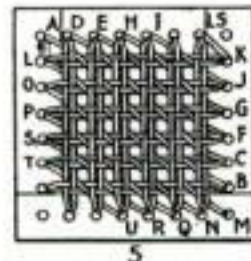
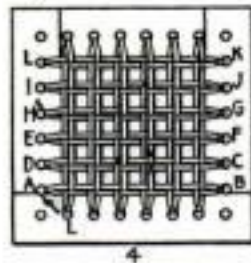
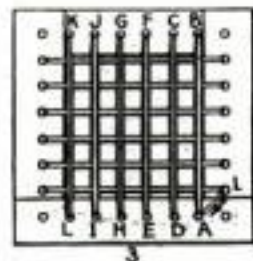
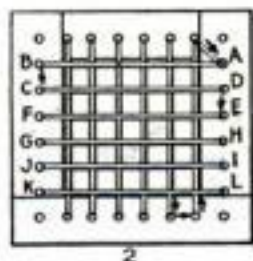
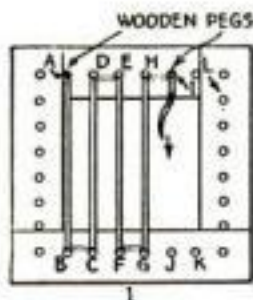
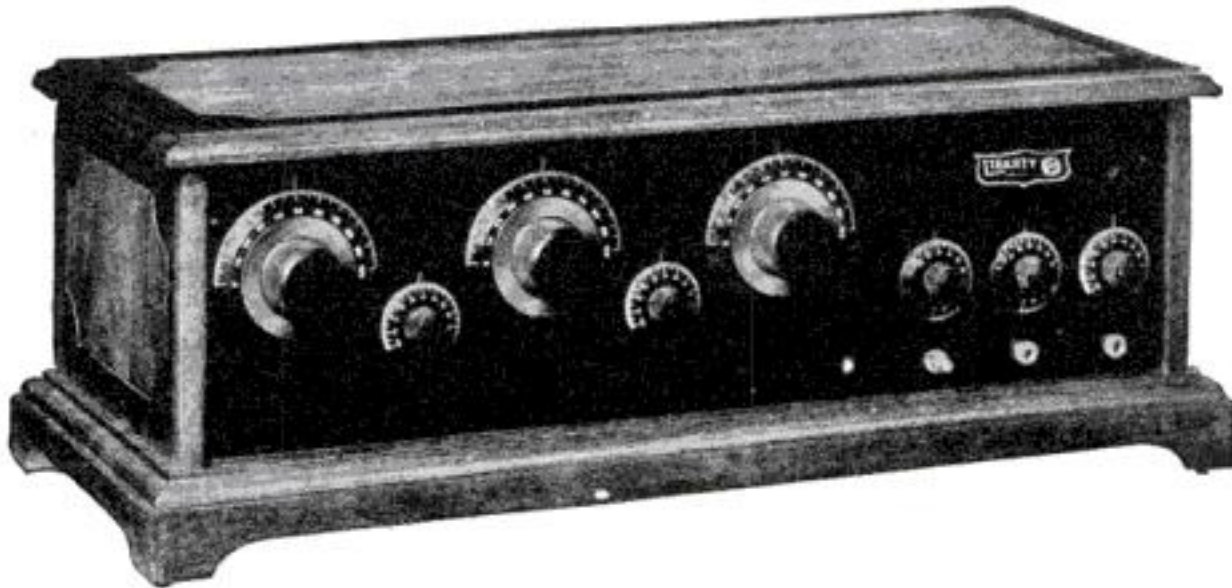


Diagram showing the simple steps by which a hand-woven chair seat is made



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"My wife said all radio sets sounded 'mechanical' until she heard the LIBERTY. That's why we bought one."



All five tubes are kept 'matched' because each tube is controlled by a separate rheostat. That gives pure tone.

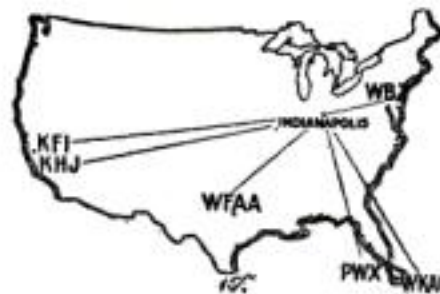
Owners of the LIBERTY Sealed Five are never without excellent entertainment.



"A strong local station near us monopolized the air until we bought a LIBERTY Sealed Five."



LIBERTY is extremely selective. You need no verniers on these large dials.



LIBERTY

IS  
built for the  
Future

"I installed one of your Liberty Five radios in my home last week and the first three nights I operated this machine I pulled in the following stations:

KFI	Los Angeles	WCAP	Washington	WCBD	Zion
PWX	Havana	WCAE	Pittsburg	KDKA	E. Pittsburg
KHJ	Los Angeles	WJZ	New York City	WLW	Cincinnati
WBZ	Springfield, Mass.	WMAQ	Chicago	WSAI	Cincinnati
WKAQ	San Juan, P. R.	WOS	Jefferson City	WMH	Cincinnati
WFAA	Dallas	WSB	Atlanta	WTAS	Elgin, Ill.
KYW	Chicago	WHB	Kansas City	WTAY	Oak Park, Ill.
WWJ	Detroit	WDAF	Kansas City	WEBH	Chicago
WCX	Detroit	WOR	Newark, N. J.	WQJ	Chicago
WOO	Philadelphia	WHAS	Louisville	WLS	Chicago
WIP	Philadelphia	WTAM	Cleveland	2XBJ	New York City
WEAF	New York City	WJAX	Cleveland	WREO	Lansing, Mich.
WOC	Davenport	WGY	Schenectady	WLBL	Stevens Point
WHAA	Iowa City	WGN	Chicago	8XG	Willard Test
WBAP	Fort Worth	WCAL	Northfield, Minn.		
WRC	Washington	WHN	New York		

"I think the above test is remarkable inasmuch as I was not familiar with the operation of the set. Might also state that my residence is not located in a very desirable spot for reception but nevertheless the above stations were received in a very clear tone and with plenty of volume on the Loud Speaker.

"I wish you all the success you deserve with this wonderful set.

"Yours very truly,

(Signed) M. E. Mogg, President,  
LINTON CONSOLIDATED  
COLLIERIES COMPANY,  
INDIANAPOLIS."

**\$100**

less accessories for  
this 5-tube tuned  
Radio Frequency  
receiver in beauti-  
ful two-tone solid  
walnut cabinet.

**I-N-V-E-S-T in a LIBERTY Sealed Five**

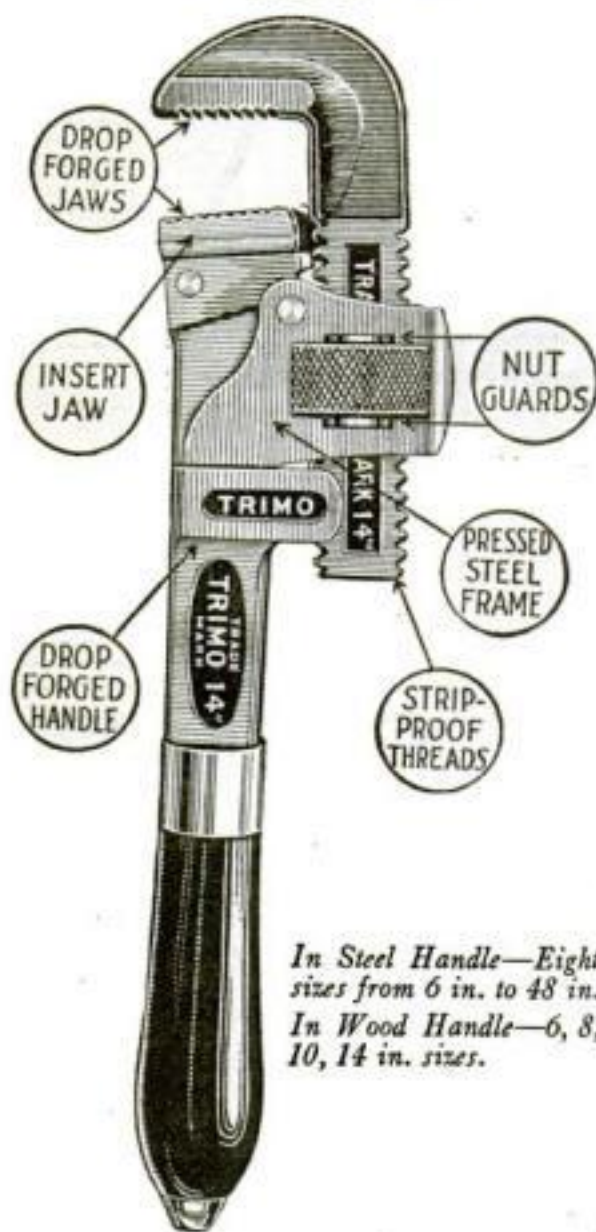
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In Steel Handle—Eight sizes from 6 in. to 48 in.  
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Roxbury, Mass.

America's Leading Wrench Makers  
for nearly 40 years

## The Home Workshop

### How You Can Construct Easily a Trick Savings-Bank for Coins

By Kenneth B. Murray

MR. MURRAY, who is well known to readers of POPULAR SCIENCE MONTHLY for his articles on the construction of ingenious novelties, is an amateur magician of established reputation and an expert on sleight-of-hand illusions. His next article will tell how to make a palming device for cards.



bank is shown in Fig. 5. The secret of the trick bottom is revealed in Fig. 4, which shows how two of the bolts on the bottom are faked. Two of the bolts act as pivots on which the bottom can swing; they are real. The other two consist of the bolt heads only, soldered in place.

When the secretly hinged bottom of the

bank is closed, the short projecting ends of the fake bolts catch into corresponding indentations in the bottom, or, better still, although not shown in the accompanying photographs, into holes the same as those for the real bolts. Being a tight fit, the bottom is held by the short bolts securely and it is necessary to exert considerable force with the thumb, as shown

in the upper illustration, to open the bank. A coin slot, of course, is made in the top.



Fig. 1—The parts needed for making the bank

IT IS practically impossible for the uninitiated to open the bank illustrated, simple as its construction is. It can be made at small expense from sheet steel and brass bolts.

The parts necessary are shown in Fig. 1. The wide side pieces for the bank are 4 in. square, while the narrow side pieces and the bottom and top are 3 by 4 in., with flanges of approximately 7/16 in.

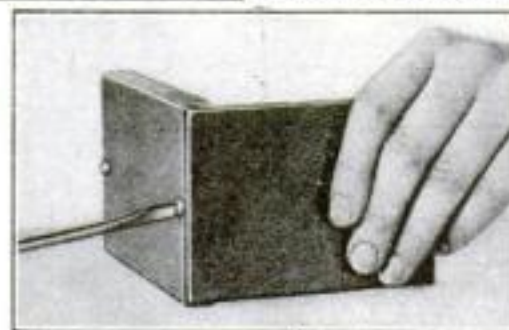


Fig. 2—Fastening a side and an end piece with bolts

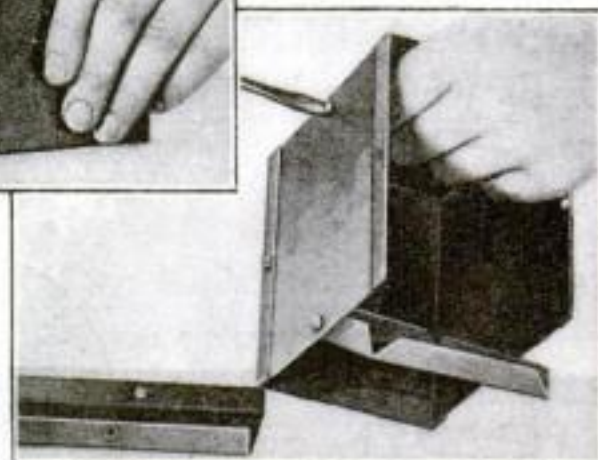


Fig. 3—Putting the top in. Note how the bottom is pivoted on two bolts



Fig. 4—The bank open

firmly after each is fastened in place by hammering it as one would clinch a rivet. It must not be possible to unscrew the nut from the bolt. The completed



Fig. 5—Ready for use

### Waxed Cloth Sometimes Is Useful as Glass Substitute

INSTEAD of glass for the windows of poultry houses, hotbeds, cold frames, and even storm doors, it is possible to use cheesecloth or other light weight white cloth treated with paraffin. The wax, shaved very fine with knife or block plane, is spread on the cloth and pressed into it with a warm but not hot electric iron.

It is important to use plenty of paraffin and to cover only a small section at a time.

The cost of the waxed cloth is about one-half that of ordinary glass. While the cloth does not admit the light like glass, it is transparent enough so that newspaper type can be read through it. —CLAUDE O. SOOTS, North Salem, Ind.



# Music Master Success



**Music Master**  
Resonant Wood Insures  
Natural Tone Quality

Model VI, 14" wood bell \$30  
Model VII, 21" wood bell \$35

Connect Music Master in place of headphones. No batteries. No adjustments.

Prices of all models slightly higher in Canada

—Its True Significance



Model VIII, Mahogany Cabinet \$35 with "full-floating" wood horn



Model V, wood bell, Metal Cabinet, Mahogany finish \$18

THE advent of Music Master sounded the death knell of the mere "loud speaker." For it transformed the radio receiving set into a musical instrument—a triumph of re-creative art.

Two years ago Music Master's full voiced volume and characteristic tone qualities heralded the New Era of Radio Art. It made possible the re-creation of supreme Music, Song and Speech, in the wonderful stellar programme now an established feature of American nation-wide broadcasting.

Music Master does more than reproduce—it interprets, it re-creates—it transforms mere radio receiving into artistic enjoyment. Music Master has been imitated often, but without success. Music Master remains the unsurpassed musical instrument of radio—and there IS no substitute.

## MUSIC MASTER—the Ultimate of Artistic Radio Re-Creation

Music Master's precision instrument is the acme of scientific perfection. Music Master's tone chamber of heavy cast aluminum is a marvelous mold of sound without distortion. Music Master's amplifying bell of resonant wood gives to every sound its full, vibrant qualities and natural and lifelike characteristics.

Music Master's manufacturers hold that every purchase of their product carries with it an implicit pledge of unreserved and unconditional protection. Back of your dealer's full and unfailing service stands the Music Master Corporation to guarantee its products direct, to anyone, anywhere, at any time.

## Music Master Corporation

Makers and Distributors of High-Grade Radio Apparatus

Tenth and Cherry Streets

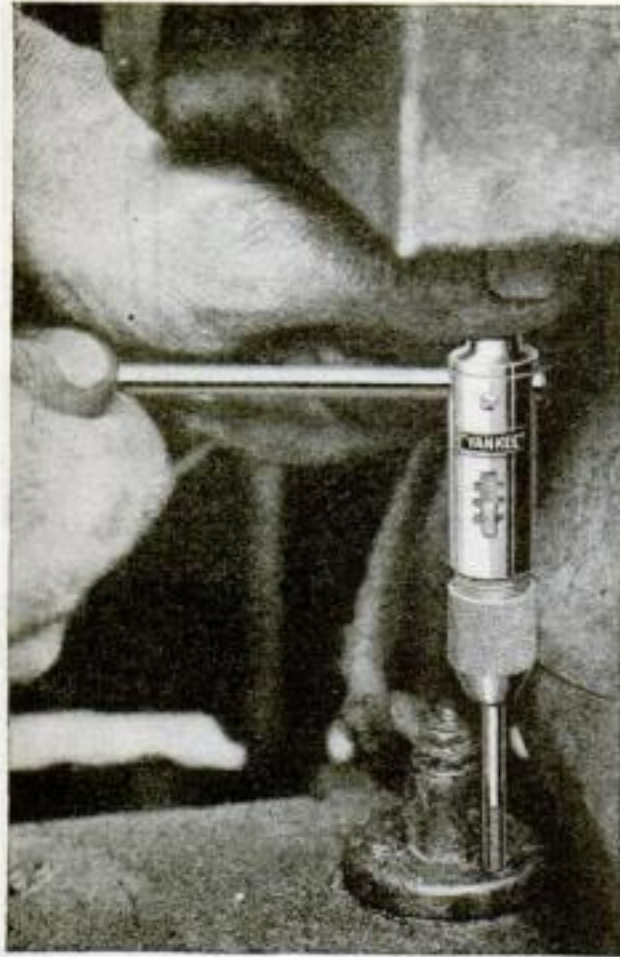
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Canadian Factory: Kitchener, Ontario





## An awkward job made easy by the "YANKEE" Ratchet Tap Wrench

HE had to tap a thread in the transmission case for a magneto plug screw.

Without a "Yankee" Tap Wrench he would have been compelled to remove the coil box.

But the "Yankee" Tap Wrench made this unnecessary. He just pulled the sliding cross bar out to end position, where his hand could move freely; set the Ratchet Shifter, and tapped the hole quickly and easily.

Three adjustments. Right-hand Ratchet, Left-hand Ratchet and Rigid. Knurled finger turn at top quickly starts or backs out taps.

No. 250—Length 3 1/4 in. Chuck diam. 3/4 in. Holds up to 3/16 in. taps.

No. 251—Length 5 in. Chuck diam. 3/4 in. Holds up to 5/16 in. taps.

No. 1251—Length 13 in. For jobs needing long reach. Otherwise same as No. 251.

## Some Other "YANKEE" Tools

Spiral Screw-drivers Quick-Return Spiral Ratchet Breast Drills Screw-drivers



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NORTH BROS. MFG. CO., Philadelphia, U. S. A.

# "YANKEE" TOOLS

Make Better Mechanics

# The Home Workshop

## Easily Made Cigar-Box Novelties

THE picture-frame and candlestick illustrated can be made at home more easily than almost any other piece of woodwork. It is not necessary to copy either design exactly; the method can be used with endless modifications and for ornamenting many objects, including boxes, bookends, stationery racks, inkstands, sewing trays, and the like.

The tools needed are few—a rule, a pocket-knife, and a piece of sandpaper, and, if available, a small plane, a square, a coping-saw, and a file.

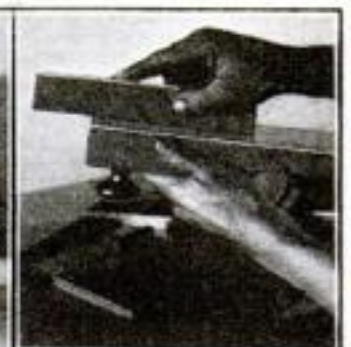
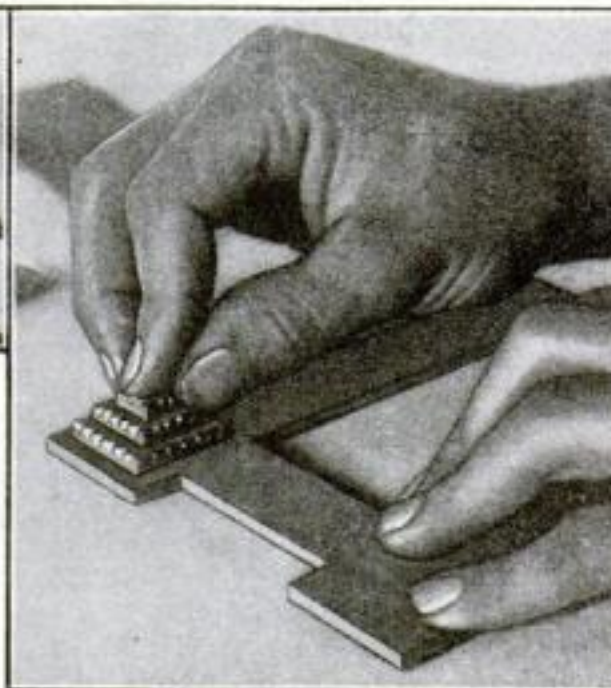
All the wood is taken from empty cigar boxes. Boxes made of Spanish cedar (a red wood that looks like mahogany) will produce the best effect, but any kind of wood can be used and stained the desired shade. A combination of various colors



divisions must come out even. Cut the notches with a thin, sharp knife, making them clean and square. The file or sandpaper is not used on them.

Mark the places for the blocks on the frame, heat the pieces slightly, if convenient, and glue them in place. Hot animal glue is quick-drying and satisfactory, but a good liquid glue will serve the purpose. Liquid glue is handled more easily when heated.

While the glue on the surface of the frame is drying, make the strips to hold the glass and the picture in place on the back, and glue them. A few fine brads may be driven from the back to add strength, but do not drive them until the glue holding the blocks is absolutely dry. Then glue on the back piece



Notching blocks (at left), gluing them in place (above), and planing a thin strip (at right)

of wood, however, should be avoided.

Select a good cigar box, take it apart carefully, scrape off the paper and clean with sandpaper held on a small block. Lay out the frame (or whatever part is to be made) and use a knife to cut the outline deep into the wood. Cut a hole in the waste material to allow a coping-saw blade to be inserted; then cut out the center rectangle. If a coping-saw is not at hand, cut deeply with the knife from both sides until the wood is removed. Make the cuts on the outside edges with saw and knife, or with the knife alone. Smooth up the inside and outside edges with a wood file or sandpaper.

Make the square and rectangular blocks used to build up the surface as indicated.



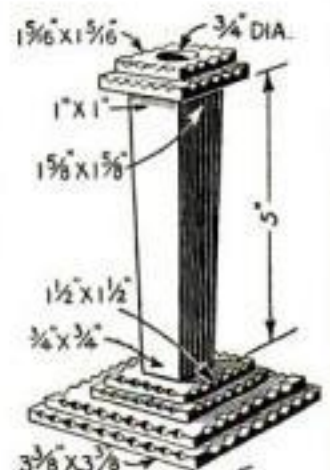
Sawing out the picture opening

The edges and ends can be sandpapered best by laying the sandpaper down and moving the block over it. Lay out the spaces for the notches on the edges of the blocks 3/16 in. apart as nearly as possible. The

proper. The glass and picture space is left open at the top so that the picture may be changed at any time. The frame may be made either to hang on the wall or to stand on a table or a dresser.

Apply a coat of mahogany stain and one or two coats of thin shellac or varnish.

In making the candlestick, the upright piece is composed of four thin pieces of wood, joined boxlike to form a post 1 in. square at the top and 3/4 in. at the bottom. An auger bit can be used in making the hole for the candle, but the coping-saw or even the knife alone will do the work. If an auger bit is used, cut out some wood for the "spur" of the bit or it will crack the board. It is also well to make the hole on a larger piece and afterward trim the piece to the required size. A piece of green felt under the candlestick finishes it off.—E. E.



Details of a notched candlestick



## The Home Workshop

### Building Model Motor-Trucks

(Continued from page 94)

$\frac{1}{8}$  by  $\frac{1}{4}$  by 40 in. strip brass for upper frame  
 $\frac{1}{16}$  by  $\frac{1}{4}$  by 80 in. strip brass for lower frame and motor fastening  
 $\frac{1}{16}$  by  $\frac{1}{4}$  by 18 in. brass for swing strips and extras  
 $\frac{1}{4}$  by  $\frac{3}{4}$  by 8 in. brass for axle boxes  
 $\frac{3}{8}$  by  $\frac{3}{8}$  by 8 in. angle brass for spring plates  
 $\frac{1}{16}$  by  $\frac{3}{8}$  by 12 in. strip brass for journal-box lids  
 $\frac{3}{4}$  by 12 in. thin spring brass for contact shoes  
Open spiral spring  $\frac{3}{16}$  in. in diameter, 12 in. long, for body springs  
1 box  $\frac{3}{32}$  by  $\frac{1}{4}$  in. machine screws with tap and drill to suit  
1 box  $\frac{1}{2}$  by 1 in. machine screws with tap and drill to suit  
1 box  $\frac{3}{8}$ -in. round-headed wood screws for end-beam fastenings, etc.  
 $\frac{3}{8}$ -in. flat-headed wood screws for attaching upper bolsters, etc.  
These lengths and amounts are in excess of actual requirements to allow for unavoidable waste and spare stock

#### In the way of tools you will need:

An assortment of twist drills containing at least every alternate size from No. 10 to No. 60  
A drill gage from 0 to 60  
A breast or electric drill stock to hold up to  $\frac{1}{4}$ -in. drills  
1 doz. fine 8-in. hacksaw blades with frame  
1 doz. fine scroll saw blades with frame  
A few flat, three-cornered and rat-tail files  
An assortment of square- and round-nosed pliers with wire cutters  
Medium-size tin snips  
A small anvil  
A vise with jaws at least 2  $\frac{1}{2}$  in. wide  
Ordinary household tools, such as light and heavy hammers, saws, and the like, are taken for granted. If possible, provide yourself with a pair of calipers, a set of small tap and dies with tap wrench and die stock in sizes from  $\frac{1}{8}$  in. up. The  $\frac{1}{8}$ -in. size will be handy when you come to making controller handles and similar work. You may also require 16  $\frac{1}{4}$  by 1 in. bolts such as can be had from any dealer in model-making supplies, but these will be mentioned later on. Make sure that all your brass stock is square, flat, and free from warp

LET us begin with the axle boxes. Study Fig. 6 of the mechanical drawings on page 94—the top and side views of the journal box stock after it has been drilled. The  $\frac{1}{4}$ -in. holes are for the journals and the  $\frac{1}{8}$ -in. holes are for the bolts that hold the journal boxes.

Before being cut apart, the strip of boxes forms an excellent templet for boring the box bolt holes in the upper and lower side pieces. Remembering that the wheel base of the truck is 3  $\frac{1}{4}$  in., note that the journal holes A and B are also 3  $\frac{1}{4}$  in. apart. From this it follows that the bolt holes 2 and 3 and 7 and 8 must correspond with the bolt holes in both upper and lower side frames.

For the side frames, cut 8 pieces 7 in. long; 4 of these are  $\frac{1}{8}$  in. and 4 are  $\frac{1}{16}$  in. thick. The lower frame is only  $\frac{1}{16}$  in. thick, while the upper is  $\frac{1}{8}$  in. thick. Take one of these pieces and scratch a mark across it precisely in the center. Now place it in the vise with the still assembled boxes so that the  $\frac{1}{4}$ -in. faces of each piece are in accurate contact through their entire length and bolt hole No. 5 exactly bisects the scratches in the center of the  $\frac{1}{8}$  by  $\frac{1}{4}$  in. frame piece.

NOW, using a  $\frac{1}{8}$ -in. drill and bolt holes 2 and 3 and 7 and 8 as guides, drill through the side frame. Remove the journal box piece and putting the frame piece alone in the vise, drill a  $\frac{1}{8}$ -in. hole  $\frac{1}{2}$  in. each side of the center scratch, and another  $\frac{1}{8}$ -in. hole with its center  $\frac{3}{16}$  in. from each end of the frame piece. If you have been careful to see that all holes have been drilled accurately along the

(Continued on page 102)

## SAVE HALF-INSTALL YOUR OWN PLUMBING AND HEATING BY OUR New Easy Method



ANY HANDY MAN can install his own Plumbing and Heating by our New Easy Method and Save Half. In the past 50 years, we have saved our customers hundreds of thousands of dollars in the cost of: Plumbing Goods, Pipeless and Warm Air Furnaces, Steam Boilers, Hot Water Boilers, Water Supply Systems, Water Heaters, Bathroom Outfits, Pipes, Radiators, Valves, Supplies, etc.

### BIG HANDY MAN BOOK

Tells the whole story. Shows the Hardin-Lavin New Easy Method. Send coupon with 25c (regular price 50c, refunded on first order) for your copy today. This Big, Instructive, Well-Bound "Handy Man" Book-Catalogue shows 10,000 items in latest style, highest quality Plumbing and Heating Fixtures and supplies at Wholesale Prices.

#### Hundreds of Trade Secrets

Also shows many valuable diagrams, plans and elevations of simple installing systems, trade secrets and money, time and labor saving kinks. Most valuable book of its kind published. SEND 25c FOR YOUR COPY TODAY.

#### Read Our Guarantee

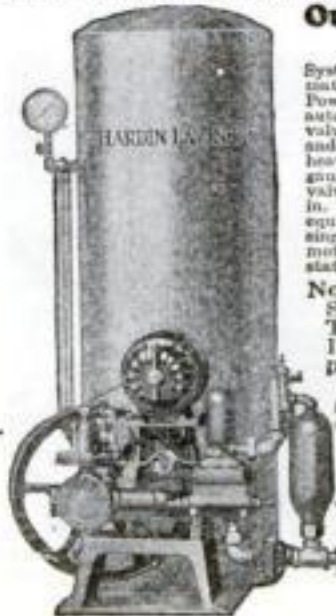
Write this magazine or your bank about our 50 years' record of square dealing and about our new million dollar plants. ORDER TODAY AND SAVE. YOU CAN NOT LOSE.

### Super Improved Automatic Electric Water Supply System

Absolutely reliable, fool-proof and simple. Can be depended upon to give lasting service with practically no attention. No better outfit made for SHALLOW WELLS OR CISTERNS WHERE WATER IS NOT OVER 22 FEET BELOW SURFACE.

#### Noiseless Pump Runs in Oil

Noiseless, double acting, brass fitted throughout and fully enclosed and lubricated by the "New Splash System." All moving parts run in oil bath which insures long life. Latest type over-size 1-hp. Horse Power electric motor, operates economically and is thoroughly reliable; surplus power to drive pump under all conditions.



#### Outfits Complete—No Extras

System consists of pump with automatic air valve, over-size 1-hp. Horse Power repulsion induction motor, automatic switch set at 40 lbs., relief valve, shut-off valves, necessary pipe and fittings as shown; one galvanized heavy pneumatic tank with pressure gauge, one  $\frac{1}{4}$  in. galvanized foot valve and strainer. Pump has  $\frac{1}{4}$  in. suction and discharge. Outfit equipped with 60 cycle, 110-220 volt, single-phase alternating current motor. If you have other current, state voltage, etc.

No. A.—500. Water Supply System with 42 Gallon Tank, Shipping Weight 300 lbs. Price, complete, Special **\$98.50**

No. A.—501. Water Supply System with 80 Gallon Tank, Shipping Weight 340 lbs. Price, complete, Special **\$110.50**

No. A.—502. Water Supply System with 100 Gallon Tank, Shipping Weight 380 lbs. Price complete, Special **\$122.50**

### CHICAGO HIGH GRADE BATH-ROOM OUTFIT \$59.95



Complete Bathroom Outfit, built along practical and attractive lines. Highest grade possible to make. Shows that First Quality Hardin-Lavin products can be had at low cost.

WHITE ENAMELED BATH TUB Cast Iron, heavy white porcelain, enameled inside and over the  $\frac{3}{4}$  inch turned-over rolled rim; outside painted. Newest Design. Fitted complete with heavy brass, nickel-plated compression bath faucet, with china indexed handles, nickel-plated heavy brass adjustable waste and overflow and supply pipes to floor; width 30  $\frac{1}{4}$  in., length 4  $\frac{1}{2}$  or 5 ft., weight 300 lbs.

Chicago A-50—Bathroom complete as shown with iron-pipe connections, Special **\$31.10**

#### White Closet Outfit

Improved, above-white composition China Closet tank (beautiful and indestructible); fitted with solid brass elevated, noiseless valves and improved china flushing handle.

Highest grade white vitreous China, syphon washdown bowl. Highly polished, reinforced birch mahogany seat, with heavy brass, nickel-plated brass hinges, flushing valve, supply pipe, closet bolts, etc., weight 125 lbs.

Chicago A-52—White Closet Outfit, complete as shown with iron-pipe connections, Special **\$19.95**

Chicago A-53—Bathroom outfit, complete as shown and described, Special **\$59.95**

All shipped from Chicago plant same day as order is received. Order today. You cannot lose.

#### Heating Plants

##### Cut-To-Fit

##### Hot Water—Steam—Hot Air—Pipeless

Hardin-Lavin Cut-To-Fit Hot Water Heating Plants give highest heat efficiency at lowest cost. Boiler embodies best engineering; easy dumping grates; long indirect fire travel that insures complete combustion and greatest heat. Our modern equipment and 50 years' practical experience qualifies us to produce this boiler that will burn any kind of fuel, cleanly, completely, and economically.

WE HELP YOU PLAN. Every Hardin-Lavin Heating System is figured to eliminate long runs of piping, to save valuable time, and expensive labor. With our complete instructions and simple installing features, you can do the work yourself and save. We loan the tools if necessary. WRITE TODAY FOR LOW WHOLESALE PRICES.

#### Free Estimate

Send us rough sketch, plan or blue print of your home and we will figure the wholesale cost of a simplified cut-to-fit Heating or Plumbing System that exactly meets your needs. We will show you many wrinkles where you can make money savings that will surprise you. Our Bonded Guarantee protects you. Behind this, stands our million dollar plants and record of 50 years.

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HARDIN-LAVIN CO.

Established 1875

When in Chicago, visit our new plant at 106-16 W. Pershing Rd., Chicago

HARDIN-LAVIN CO., 106-16 W. Pershing Rd., Chicago, Ill.

Gentlemen: Enclosed please find 25c (if regular price) for which send me your Big Complete "Handy Man" Book-Catalogue with special Wholesale discount sheets and FREE Bulletin Service. I am interested in:

☐ Water Supply System ☐ Plumbing Fixtures

☐ Steam Heat Plant ☐ Bathroom Outfits

☐ H. W. Heat Plant ☐ Pipeless Furnace

Note: "Handy Man" Book is FREE if order accompanies coupon.

NAME.....

ADDRESS.....

CITY.....STATE.....

### Medicine Cabinet, Special..... \$8.95

Highest Grade White Enamel Steel; all joints electrically welded before enameled with four coats of baked enamel, inside and out. Has plate glass beveled mirror, two plate glass shelves, heavy glass knob and enameled non-sag hinges. Cabinet is guaranteed to be entirely satisfactory and carefully crated to reach you in first class condition. Hang on any wall with two screws. Height 21 in., width 16 in., depth 5 in., wt. 35 lbs. No. 5137—White Enamel Cabinet, Special, reduced to.....\$8.95

Chicago A-51—Lavatory. Complete as shown with iron-pipe connections. Special **\$11.75**

Chicago A-53—Bathroom outfit, complete as shown and described. Special **\$59.95**

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#### Deep Apron Lavatory

Late design, white porcelain enameled, cast-iron deep apron lavatory, supported on concealed wall hangers; new low design, china indexed compression faucets, heavy brass, nickel-plated adjustable supply pipes and trap to floor or wall, size 17x19  $\frac{1}{4}$  in., weight 120 lbs.

Chicago A-51—Lavatory. Complete as shown with iron-pipe connections. Special **\$11.75**

Chicago A-53—Bathroom outfit, complete as shown and described. Special **\$59.95**

All shipped from Chicago plant same day as order is received. Order today. You cannot lose.

#### Hot Water Boiler

Hot Water Boiler

Pipeless Furnace

Pipeless Furnace

Pipeless Furnace

Pipeless Furnace

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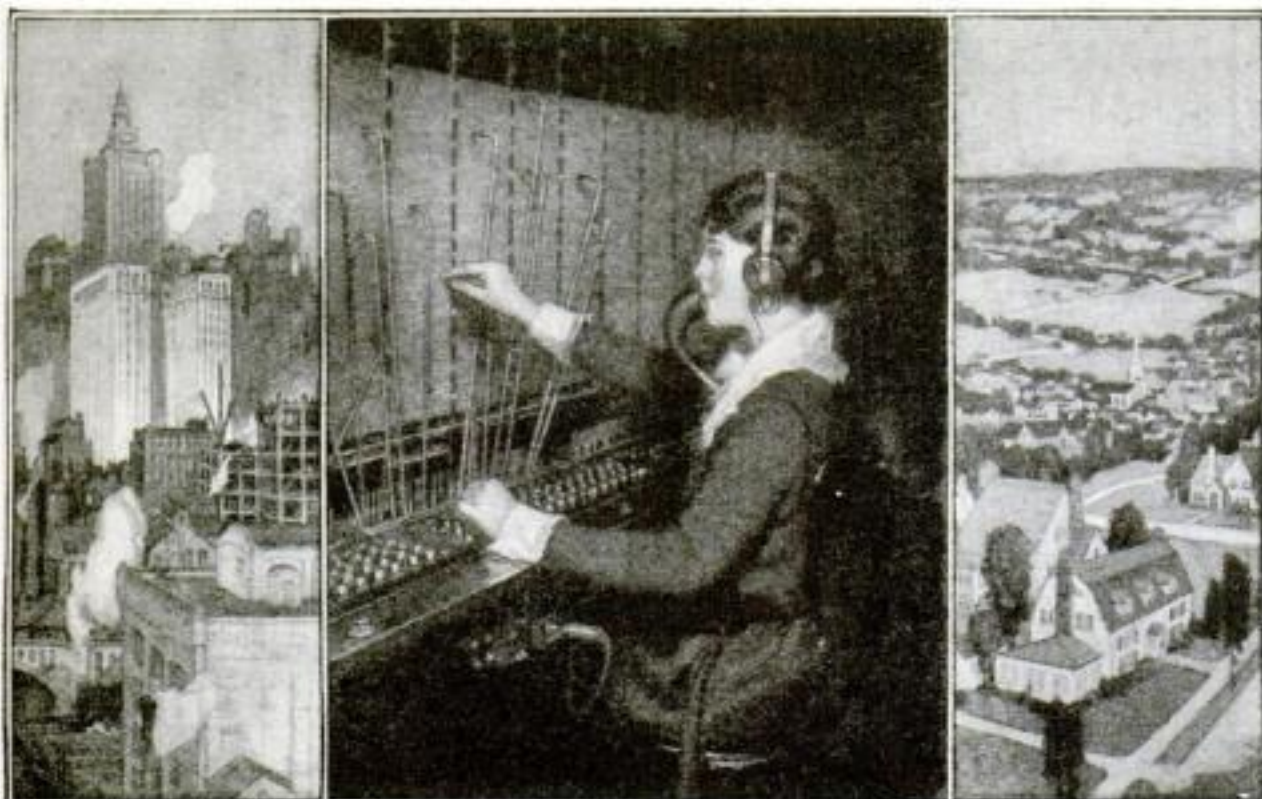
Pipeless Furnace

Pipeless Furnace

Pipeless Furnace

Pipeless Furnace





## At Your Service

The courteous girl at the switchboard speaks the first word in more than two million conversations an hour. Presiding day and night at the busy intersections of speech, she is always at the call of the nation's homes, farms and offices.

Out of sight, and most of the time out of hearing of the subscribers, little is known of the switchboard girl—of her training and supervision under careful teachers, and of her swift and skilful work. Likewise, little is known of the engineering problems necessary to bring the terminals of fifteen million telephones within the reach of a girl's arm, or of the ceaseless work of maintenance which in fair weather and storm keeps the mechanism fit and the wires open.

America's millions of people must have at their command means of direct and instant communication, and the Bell System must ever be in tune with the demands of national service.

These are the components of America's system of telephony: The best of engineering, of manufacture, of facilities—and a personnel trained and eager to serve.



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**BELL SYSTEM**

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See top of page 8 in front of book for details.

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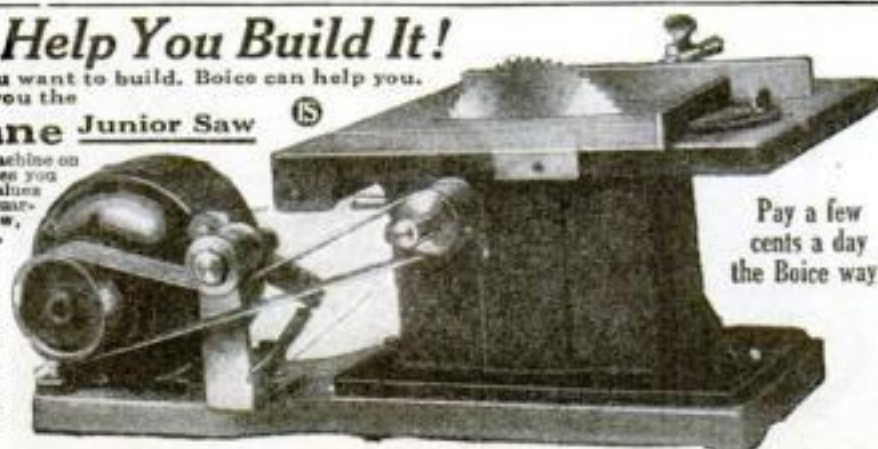
No matter what you want to build, Boice can help you. He'll send you the

**Boice-Crane Junior Saw** 

or any other Boice-Crane machine on monthly payments. He gives you unsurpassed prices and values with a positive money-back guarantee. Machine shown will saw, sand, grind, mill, rabbet, tenon, etc. Sturdy, accurate, economical. Saws 1½" stock. Sold with or without motor.

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Dept. P. S. 4-A, Toledo, Ohio  
"World's Largest Makers of Small Bench Machines"



Pay a few cents a day the Boice way!

## The Home Workshop

### Building Model Motor-Trucks

(Continued from page 101)

center line, the frame piece may be used as a templet for the remaining frame pieces. Unless you have access to a drill press, it is advisable to have the drilling of at least the journal box stock done at a machine-shop.

You now can cut apart the journal boxes with a fine hacksaw. Follow carefully the center lines of the bolt holes.

Either ⅛ by 1 in. machine screws or bolts may be used for securing the journal boxes to the frame. If screws are used, the holes in the lower frame piece must be slightly less than ⅛ in. so that they can be tapped. This method necessitates drilling the 4 upper and 4 lower frame pieces separately, but is cheaper and avoids the possibility of losing any nuts. The bolt method is shown at the right of Fig. 1, and the machine-screw method at the left.

A refinement in the journal boxes, which may be introduced if desired, is illustrated in Fig. 2. A ⅛-in. hole is drilled from the center of the bottom of the box until it intersects the bottom of the journal hole. This is for holding a bit of cotton waste for lubrication. If you drill this hole, remove the burr by filing a depression not more than 1/32 in. deep in the bottom of the journal hole.

**Y**OU now may attach the journal-box lids. Just above the top of each journal hole, drill a hole a trifle smaller than your 3/32-in. machine screws and tap this. Then cut the box lids from 1/16 by ¾ in. strip brass, as in Figs. 1 and 2. Round off the top of the lids and drill a hole for the screw large enough to admit the screw clear to its head, so that the lid can be screwed down tightly enough to act as an end stop for the journal.

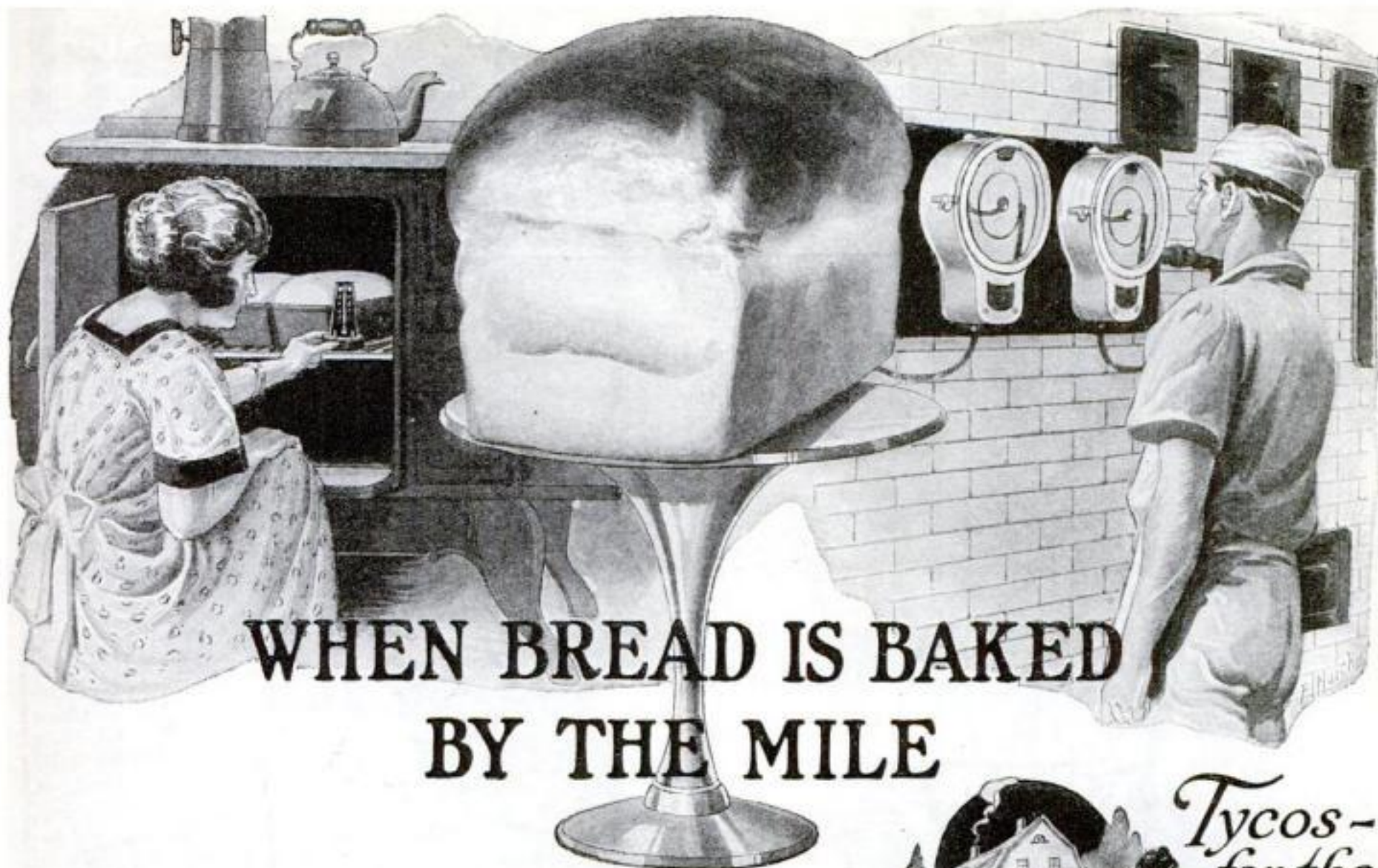
When your four side frames and boxes are assembled, you are ready to add the wooden end beams and transoms. Trim three strips of fairly hard, straight-grained wood, each about 18 in. long, to the cross sections shown. See that the edges are truly at right angles and all surfaces smooth and free from warp. There must be no knots.

Cut four pieces from this stock ¾ by ¾ by 4½ in. long for the end beams and round the ends, as in Figs. 1 and 2. Take two of the assembled brass frames and with the box lids screwed flush with the boxes, slip them over the journals. Hold them together temporarily with two rubber bands. Then insert the end beams, making sure their ends project equally at the corners. Mark the locations of the corner screw holes on the upper side, removing the end beams, and drill for ⅝-in. round-headed wood screws. Insert the screws, turn the truck upside down, mark and drill for the under side, and square the whole frame.

It is vitally important to maintain squareness throughout your work. Employ a small try-square constantly. The two trucks at this stage should run as smoothly as a billiard ball.

The next article will take up the wooden bolsters and the mounting of the motor, gearing, and springs.





## WHEN BREAD IS BAKED BY THE MILE

WHERE the gas flames leap and crackle as mile after mile of baking bread passes between them, there can be no guesswork as to the temperature of the ovens half a city block in length.

With thousands of pounds of bread and rolls to be baked every seven days, no chance can be taken on the results. Taylor Instruments for Indicating, Recording and Controlling heat—the Sixth Sense of Industry—are used to record to a fraction of a degree the tremendous heat of the ovens.

Only by using Heat Recording Instruments of the greatest delicacy can wholesale bread bakers be sure of getting the absolutely uniform results that is essential to large-volume manufacturing.

And the home baker can get the same uniform, dependable results by using the Taylor Home Oven Thermometer when baking.

Manufacturers of paints, furniture, rubber goods, metal ware, food products, steel, and all other products that go through heating processes in their manufacturing, need in their plants the Sixth Sense of Industry—Tycos Instruments for Indicating, Recording and Controlling temperature.

### MANUFACTURERS

Tycos Engineers have effected substantial economy for manufacturers in every line of industry by applying the Tycos "sixth sense." Whatever your problem in the indicating, recording or controlling of heat there is a Tycos Instrument to serve you. Write us for literature on any instrument, or type of instrument, and it will be sent promptly. Or, if you prefer, our engineers will consult with you on the application of the Tycos Sixth Sense in your plant.

### Taylor Instrument Companies

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### Tycos— for the Home

**Tycos Office Thermometers**  
An aid in promoting human efficiency.

**Tycos Bath Thermometers**  
To enable you to get the most good from your bath.

**Tycos Home Set**  
Bake Oven Thermometer, Candy Thermometer, Sugar Meter. The secret of accurate results in cooking.

**Tycos Wall Thermometers**  
To help you maintain a temperature in your house conducive to good health.

**Tycos Quality Compasses**  
To show you the right way in unfamiliar country.

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A necessity in every home.

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Forecasts the weather twenty-four hours ahead with dependable accuracy.

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To enable you to keep the humidity of the atmosphere in your home correct at all times.

Your dealer will show them to you. Ask us, on a postal, for booklets on any of the above.

### Tycos— for the Medical Profession.



**Tycos Sphygmomanometer**, Pocket and Office type.

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**Tycos Fever Thermometers.**  
Bulletins on request.

THE SIXTH SENSE OF INDUSTRY  
**Tycos Temperature Instruments**  
INDICATING • RECORDING • CONTROLLING





# They Have Stopped

## —with the help of the



YOU can do the same.

Save the Household Painting Guide on the opposite page, put it up on your wall in a permanent place, *and then*, every time you go to buy paint, varnish, stain or enamel, look at the "Guide" first.

Surfaces outdoors, constantly exposed, need types of finishes different from those that are indoors and never-exposed. Floors, constantly walked on, need a type of paint or varnish different from those used on woodwork or walls.

In a word, each type or surface calls for its own type of paint and the same is true of varnish, of stain and enamel.

The Household Painting Guide simply makes it easy to select the RIGHT material exactly as a color card makes it easy to select the right color; *it stops mistakes in painting.*

*Buy and be sure, by looking up  
"Paint Headquarters"*

*and buying from the Household Guide*

The store in your community—perhaps in your neighborhood—displaying the "Guide" and

carrying the correct Sherwin-Williams paints, varnishes, stains and enamels recommended by the "Guide," is "Paint Headquarters." The name is more than a title—it is literally correct because that store gives you service, through the "Guide," far ahead of stores which merely "sell paint." Look for the "Guide" in the window and inside the store.

No matter whether the home decorating that you plan is for a single room or the whole house, the Sherwin-Williams Dep't of Home Decoration will gladly give you individual suggestions if you write them. Ask for free booklet B450, giving practical information, and also for free set of handsome color plates. If you want the most complete book on home decorating ever issued, 177 pages, many beautiful full-page decorative schemes in colors, send 50c (65c in Canada). Write The Sherwin-Williams Co., Dept. B435, 659 Canal Rd., Cleveland, O.





# Mistakes in Painting

## Household Painting Guide

### SHERWIN-WILLIAMS HOUSEHOLD PAINTING GUIDE



SURFACE	TO PAINT— USE PRODUCT NAMED BELOW	TO VARNISH— USE PRODUCT NAMED BELOW	TO STAIN— USE PRODUCT NAMED BELOW	TO ENAMEL— USE PRODUCT NAMED BELOW
AUTOMOBILES.....	S-W Auto Enamel	S-W Auto Enamel Clear		S-W Auto Enamel
AUTOMOBILE TOPS AND SEATS.....	S-W Auto Top and S-W Auto Seat Dressing			
BRICK.....	SWP House Paint S-W Concrete Wall Finish			Old Dutch Enamel
CEILINGS, Interior...	Flat-Tone	Scar-Not Varnish	S-W Handcraft Stain Floorlac	Enameloid
Exterior...	SWP House Paint	Rexpar Varnish	S-W Oil Stain	Old Dutch Enamel
CONCRETE.....	S-W Concrete Wall Finish			
DOORS, Interior.....	SWP House Paint	Scar-Not Varnish Velvet Finish No. 1044	Floorlac S-W Handcraft Stain	Enameloid
Exterior.....	SWP House Paint	Rexpar Varnish	S-W Oil Stain	Old Dutch Enamel
FENCES.....	SWP House Paint Metalastic S-W Roof and Bridge Paint		S-W Preservative Shingle Stain	
FLOORS, Interior (wood).....	S-W Inside Floor Paint	Mar-Not Varnish	Floorlac	S-W Inside Floor Paint
Concrete....	S-W Concrete Floor Finish			S-W Concrete Floor Finish
Porch.....	S-W Porch and Deck Paint			
FURNITURE, Indoors	Enameloid	Scar-Not Varnish	Floorlac	Old Dutch Enamel
Porch.....	Enameloid	Rexpar Varnish	S-W Oil Stain	Enameloid
HOUSE OR GARAGE Exterior.....	SWP House Paint	Rexpar Varnish	S-W Preservative Shingle Stain	Old Dutch Enamel
LINOLEUM.....	S-W Inside Floor Paint	Mar-Not Varnish		S-W Inside Floor Paint
RADIATORS.....	Flat-Tone S-W Aluminum or Gold Paint			Enameloid
ROOFS, Shingle.....	S-W Roof and Bridge Paint		S-W Preservative Shingle Stain	
Metal.....	Metalastic			
Composition..	Ebonol			
SCREENS.....	S-W Screen Enamel			S-W Screen Enamel
TOYS.....	S-W Family Paint	Rexpar Varnish	Floorlac	Enameloid
WALLS, Interior (Plaster or Wallboard)	Flat-Tone SWP House Paint			Old Dutch Enamel Enameloid
WICKER.....	Enameloid	Rexpar Varnish	Floorlac	Old Dutch Enamel
WOODWORK Interior.....	SWP House Paint Flat-Tone	Scar-Not Varnish Velvet Finish No. 1044	S-W Handcraft Stain S-W Oil Stain Floorlac	Old Dutch Enamel Enameloid
<div>For Removing Paint and Varnish use Taxite—quick—easy—thorough—economical—can be used by anyone—on any surface.</div> <div> <b>SHERWIN-WILLIAMS</b>  <b>PAINTS AND VARNISHES</b> </div> <div>For Cleaning Painted and Varnished Surfaces use Flaxoap. Made from linseed oil—contains no free alkali—restores original lustre.</div>				



For the Garage



For Woodwork



For Screens



For Furniture

## New!

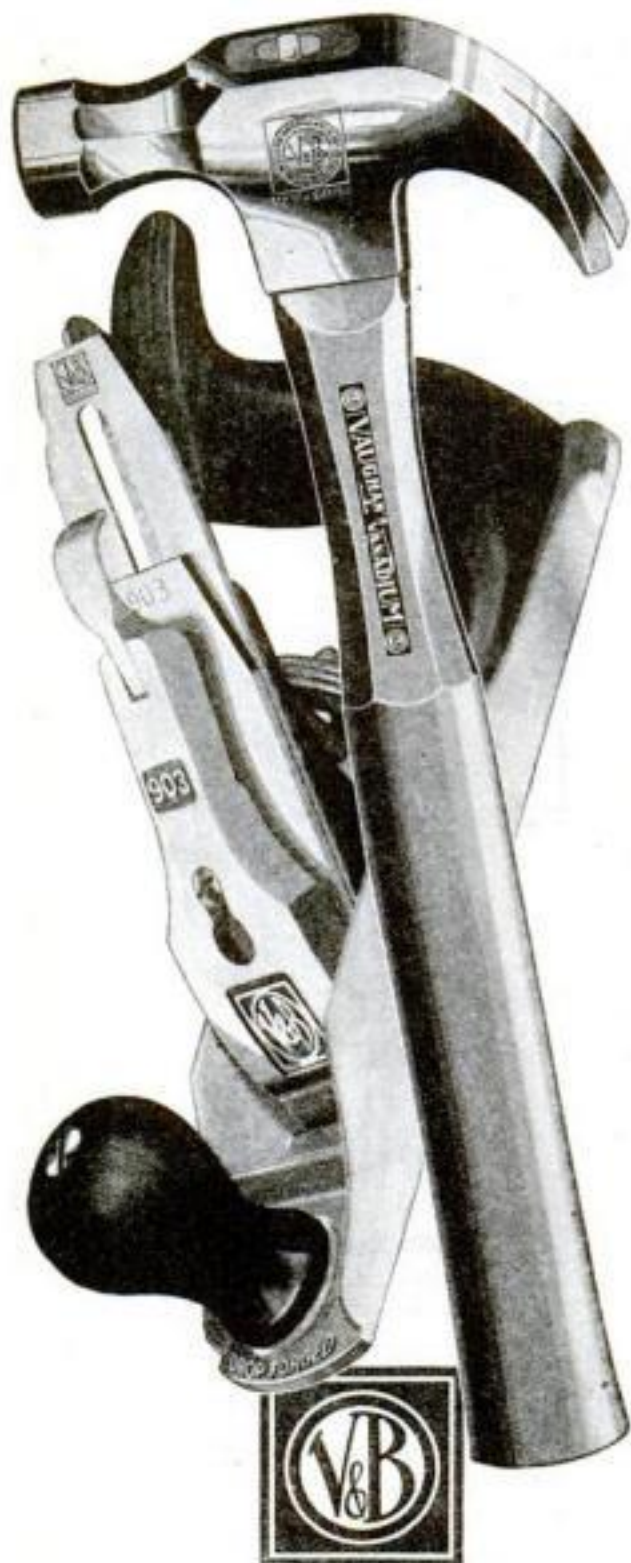
### SHERWIN-WILLIAMS Payment Plan

Arrangements have now been perfected by Sherwin-Williams whereby the painting of residential property may readily be arranged on a convenient payment basis. Recognized business practise is now, therefore, made available to the property owner without difficulty or red tape. The Sherwin-Williams "Paint Headquarters" Dealer will gladly give you full information.

### How To Hire a Painter

Give the job to a *good* painter when you hire a man to paint your house. "Paint Headquarters" will recommend good men. Good painters are worth knowing. *If you hire a painter, hire a good one.*





**VAUGHAN & BUSHNELL**  
Vanadium Hammers are aristocrats among hammers. Made from special formula vanadium steel—handled with the best grade hand-shaved second growth white hickory—designed with a special non-slip claw that grips either a brad or a spike—and equipped with a Vaughan's Expansion Wedge that firmly locks the handle tight—they are made for you craftsmen that buy quality tools.

V & B Unbreakable Planes bear the same reputation as V & B Vanadium Hammers. They are drop forged—not cast—from a solid bar of V & B Supersteel, and stand the falls and accidents that would break an ordinary plane. They are furnished with all vanadium steel blades and walnut handles in the sizes you'll want.

Your hardware dealer will heartily recommend these two tools. Ask to see them when next you are in!

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**VAUGHAN & BUSHNELL**  
**MANUFACTURING COMPANY**  
*Makers of Fine Tools*  
2114 Carroll Ave. • Chicago, Ill. U.S.A.

## The Home Workshop

### How to Erect an Aerial Pipe Mast

By B. Francis Dashiell

**T**HE erection of aerial masts has often resulted in the marring of attractive lawns or homes with unsightly, makeshift poles. Those radio fans who have attempted to erect neat pipe masts frequently have given up in disgust and discarded the bent, twisted, and unmanageable remains of their unsuccessful efforts. It is almost impossible to erect a 50-ft. mast after the pipes have been assembled, as it will bend, vibrate, and twist.

The most practicable method is to telescope three lengths of different sized pipe. The smallest or upper section should not be less than  $\frac{3}{4}$  in. pipe size. Set up the telescoped pipes in a hole 4 or 5 ft. deep. Fill in with concrete or well tamped earth and use three guy wires to brace the largest or lowest section.

Two men, working from ladders placed on opposite sides of the erected pipe, then raise the top or smallest section until it has been lifted three-quarters of its length out of the middle section. A bolt is slipped through a hole previously drilled

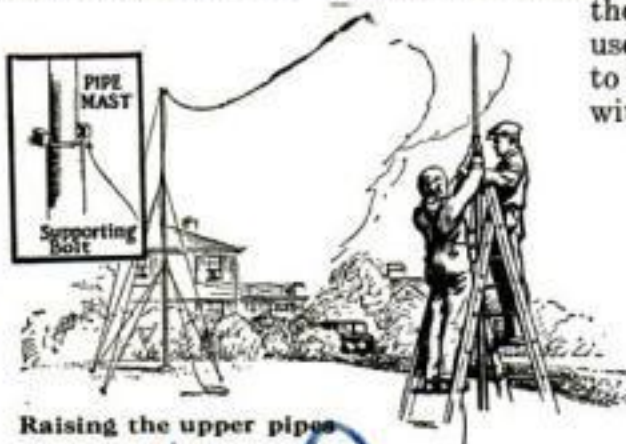
for that purpose, so as to prevent this section from telescoping or sliding down within the next larger size.

The middle or second section (now supporting the top or smallest section) then is raised and a bolt used in a similar manner to prevent its telescoping within the largest or lowest section.

Guy wires, which were previously attached to the top of the second section, are fastened to the same anchor posts used for the guys of the lowest section. It is not necessary

to attach guys to the top section, but it is well to use a single wire to counteract the pull of the aerial wires.

By using this method a 50-ft. mast may be raised in less than one hour. It is important, however, to select pipes that slide or telescope easily. Three 20-ft. lengths will make a mast that will be from 45 to 50 ft. high. Because of the weight of the pipe, it is not advisable to use more than three pieces. One advantage of this method is that the pipes can be painted before erection, and lowered when necessary for repainting.



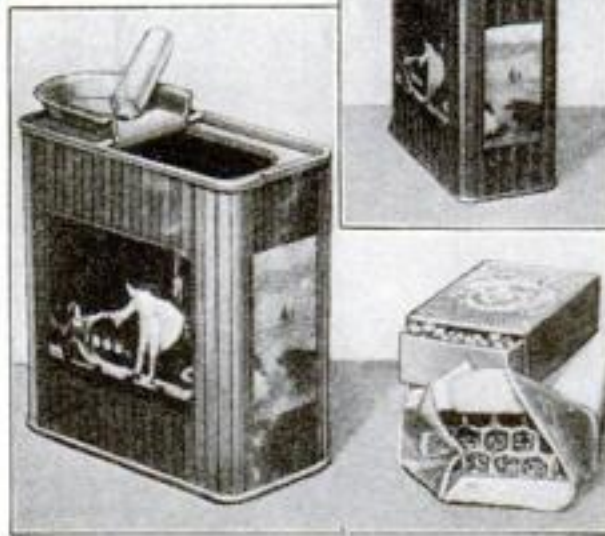
Raising the upper pipes

### Old Can Forms Ash Receiver

**T**HE ash receiver illustrated costs nothing to make, has a large capacity, and will not readily spill.

It is made from a can that contained toasted almonds. Pictures are pasted over the reading matter, while the rest of the surface decorated with panels of purple and yellow, remains unchanged.

A little shelf upon which a lighted cigarette may be laid, is formed from



An ash receiver of large capacity the lid. This is cut across one-third the distance from the end. One end of it is bent to form a hinge joint around a piece of stout wire or a nail, which is soldered in place as shown.—EDWARD H. FLAHERTY.

### Butterfly Paperweight Is Attractive Desk Ornament

By Clyde E. Volkers

**I**F YOU have stored away somewhere a discarded glass paperweight, you can convert it into an attractive desk ornament by replacing the colored print with a small butterfly or moth.

The glass first is cleaned thoroughly. Cut a piece of stiff paper or thin cardboard that will fit the bottom of the paperweight. In the hollow cavity of the glass, place the butterfly so the more attractive side will be seen from the top. Arrange a piece of brightly colored grass, or a dainty bit of flower over the butterfly. As a background use a thin sheet of white or stained cotton or the silky down from milkweed pods.

Glue the cardboard to the back of the weight to hold the cotton, flower, and butterfly in place. Acetic glue is excellent for this purpose. It is made by heating 18 parts of glue flakes (previously softened by soaking overnight in a little cold water) with 2 parts of acetic acid until a thick liquid is formed.



A unique paperweight



# CIR-KIT



## More Power per Tube brings Greater Radio Most Economically

### SEE ERLA RECEIVERS

Inherent Erla advantages in power, tone and selectivity are now available in beautiful complete Erla receivers. Retail prices range from \$67.50 to \$225. Both price and performance place Erla receivers among the sensations of radio history.

Triple power is the basis of Erla Supereflex records. Tubes, as used in Supereflex, simultaneously amplify received radio frequency currents, reflexed radio and reflexed audio frequency currents. So 1-tube Supereflex rivals the power of conventional 3-tube circuits. And 3-tube Supereflex readily outclasses the ordinary five!

Only such power can give you the thrill of Supereflex distance and volume; always with Erla crystal-pure tone—and with uncanny selectivity that gets what you want when you want it.

This finer radio is brought within the reach of all by Erla Supereflex CIR-KIT, the factory-sealed carton of genuine Erla apparatus for building Supereflex yourself. Anyone can follow the CIR-KIT assembly plan perfectly, using only screwdriver and pliers, without drilling or soldering.

Pride of workmanship, extreme economy, priceless radio performance, are yours in Erla Supereflex CIR-KIT. Select your model at the Erla store. 1 to 5 tubes, antenna and loop types.



**Electrical Research Laboratories**  
Department S, 2500 Cottage Grove Avenue, Chicago

# ERLA







## The Home Workshop

### Simply Made "Skates" Aid in Handling Heavy Radiators

AFTER my father strained his back moving a radiator, I devised the two small trucks or "skates" illustrated. Each one is made by screwing four casters on a wooden block, 2 by 4 by 12 in. One pair of casters is set back from the end about 2 in.; the other is even with the end.

In use, the overhanging end of the skate is placed under the end of the

Bottom view of one of the trucks and how it is used



radiator. By pressing down on the other end of the skate, the radiator is lifted sufficiently to allow the skate to slip under. With a skate under each end, the radiator can be wheeled easily.—R. B.

### Sturdy Wooden Plant Stands

(Continued from page 108)

corners of both sides of these pieces so that the legs and nails may be placed accurately. The uprights are kept  $1\frac{1}{2}$  in. inside the edges. Two tenpenny nails are driven into each joint. The rubber tacks are driven into the base near the corners. The completed pieces are stained and waxed or stained and given a coat of flat varnish.

The material required for the second pair of pedestals is as follows:

- 2 boards 1 by  $5\frac{1}{4}$  in. by 14 ft.
- 1 board 1 by 11 in. by 4 ft.
- 1 strip 1 by  $1\frac{1}{2}$  by 16 in.
- A few sixpenny and tenpenny nails

The 14-ft. boards are cut into eight lengths of  $37\frac{1}{2}$  in. The ornamental holes are marked in the center of each piece, beginning 14 in. from the bottom and running to  $11\frac{1}{2}$  in. from the top. After boring the holes, cut out the  $\frac{1}{2}$ -in. strip with a compass saw.

The four top and bottom pieces are 11 in. square. They are fastened to the sides 1 in. from the edges with four tenpenny nails at each joint. The eight feet are sawed from the 1 by  $1\frac{1}{2}$  in. strip and fastened at the corners of the bottom with two sixpenny nails in each joint.

Sandpaper the pieces before assembling, making the strokes lengthwise with the grain. The wood for the tops and bottoms should be planed before being sandpapered. After assembling, the edges are chamfered or rounded off.

The heads of the nails are set  $\frac{1}{8}$  in. deep and the indentations filled with putty that is colored with stain.—J. T. GARVER.



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*By the Chief Chemist*

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THE PALMOLIVE COMPANY (Del. Corp.), Chicago, Ill.

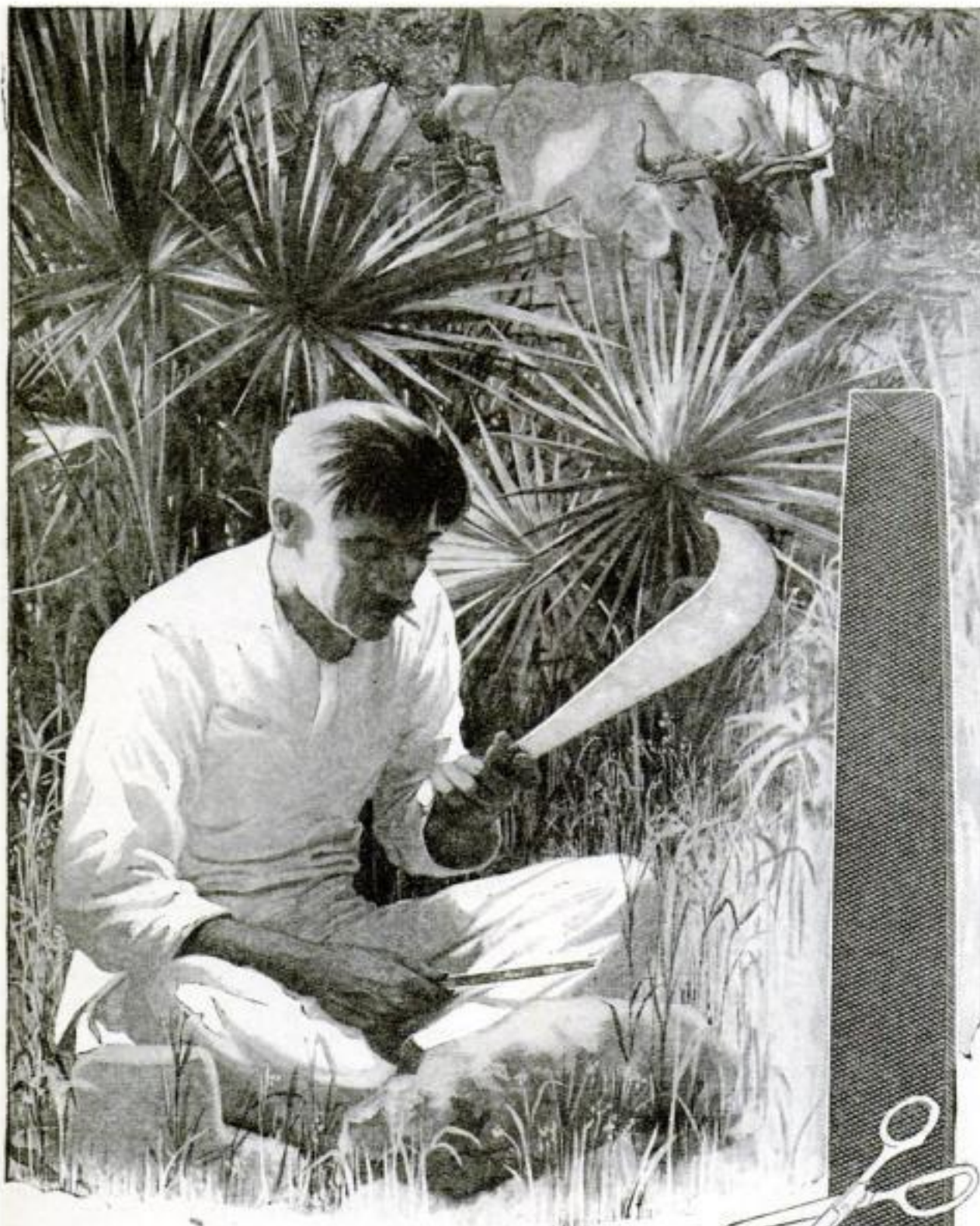
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## The Home Workshop

### Fumeless Chicken Brooder Costs Little to Construct

By L. B. Robbins

WHILE there are many types of brooders for raising chicks, the one illustrated has been tried out with the greatest success for several seasons by the builder. It can be built for practically nothing and will raise easily from 50 to 60 chickens until they are six weeks old. It is used indoors.

Poisonous fumes from the lamp—the most dreaded thing to contend with in brooding—practically are eliminated, yet

Brooder with  
hover removed

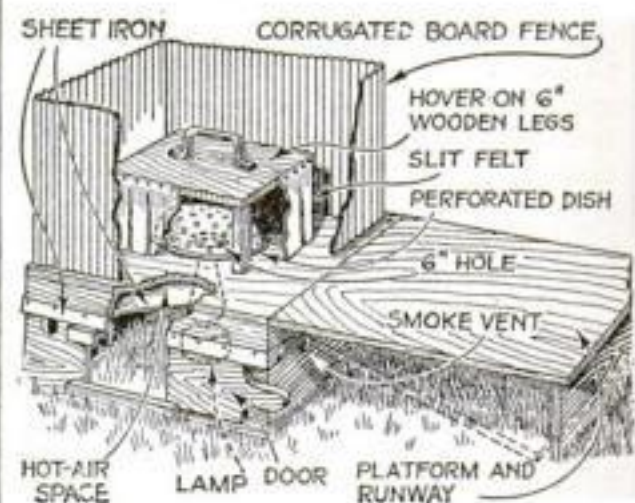


the heat is distributed so that the chicks can secure any degree of warmth.

The body of the brooder consists of a wooden frame 32 in. square by 12 in. wide. Across the top of this frame tack a piece of sheet zinc or iron and turn the edges down all around. A strip of sheet asbestos between the edges of the board and the metal will make a tight joint. This completes a strong, boxlike structure with an open bottom and a metal top.

Nail four pieces of 3-in. furring around the box and over the metal. Use long wire nails to go through the furring and the metal and into the frame. Then floor this second structure over with thin, matched (tongued-and-grooved) boards, making as tight joints as possible. This construction forms a 3-in. air space above the lower frame.

Cut a 6-in. hole in the center of the flooring and invert an old cooking dish



Heat from the lamp is transmitted through a metal diaphragm to a hot-air radiator

over it, fastening it to the floor with small brads. The dish should be punched full of small holes to radiate the warmth from the hot-air chamber.

A square hole is sawed in one side of the body of the brooder, as indicated, and fitted with a sliding door.

The hover consists of a thin wooden panel 24 in. square set on four wooden legs 6 in. high. Fit some sort of a handle

(Continued on page 111)

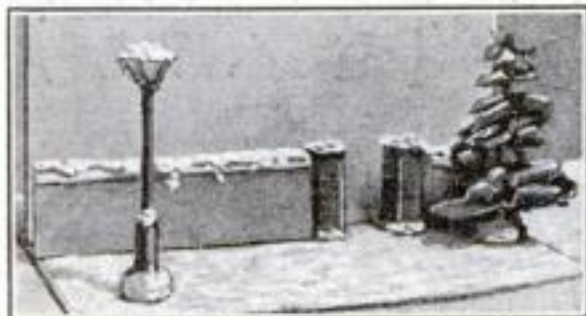


## The Home Workshop

### Sealing-Wax Aids in Making Toys and Models

**SEALING-WAX** is a useful medium for making interesting little toys as well as colorful models such as the one illustrated, which is an amateur theatrical scene, built on the scale of  $\frac{1}{2}$  in. to 1 ft.

The back drop is a piece of illustration board painted with water colors. The wall and gate are stiff drawing paper. The snow on the wall is white wax. By drawing the soft wax slowly off the edge and then cutting the threads with a scis-



Miniature scene for amateur theatricals made with sealing-wax on illustration board and paper

sors, realistic drifts and icicles are formed. The lamppost is a 20-penny nail standing on its head and covered with black and white wax.

When the wax is soft it can be molded easily with the fingers or with small knife blades and large needles. Cylinders or spheres are formed by twirling the wax carefully over an alcohol flame. As the last step, a brilliant gloss can be given to the work by running it quickly through the flame.—KENNETH M. SWEZEY.

**INSOLES** for shoes may be cut from an old felt hat. They are fully as satisfactory as commercial insoles and cost nothing. If thoroughly washed, a piece of old felt hat makes a good rubbing felt for finishing woodwork. The felt also is useful for cutting gaskets.—W. L.

### Fumeless Chicken Brooder

(Continued from page 110)

to the center of the top and tack a 6-in. strip of felt around the edges. Slit up the felt at intervals of 2 in., so that the chicks may pass in and out of the hover.

For heating use a regulation brooder lamp or a common lamp with short chimney. Light it and place it under in the center of the lowest compartment. Provide a few holes along the top edge of the wide frame, below the metal ceiling, to carry off the fumes. The air in the 3-in. space above then becomes heated without odor. The heat passes out of the holes in the heating drum and warms the interior of the hover. An average size flame will maintain 90 degrees in cold weather.

Corrugated board, tacked about the brooder as indicated, can be used to fence the young chicks in for the first few days and then extended as they increase in age and size. An extension platform can be hinged to the front to furnish the birds more floor space and finally let down to form an inclined runway when they are allowed to have an outside run.

This brooder may be cleaned readily, is safe, and will raise strong, healthy chicks.



## WORTH WHILE TOOLS

**T**HERE is satisfaction in the ability to tackle odd repair jobs about the home; and if one has the energy and determination to do some of this work himself, the savings in time and money will be considerable.

The kind of tools used often determines the quality of the work. To be sure of the best results, get the right tool for the purpose. There's a large variety of Pexto Tools made in all practical styles and sizes. You can't go wrong if you insist on these century-famous tools.

For the mechanic and for general home use, the Pexto Samson Ratchet Bit Brace, illustrated above, will give a lifetime of dependable service and stand up under the severest 'roughing.' Its ball-bearing chuck gives the Pexto Brace a grip that never lets go. It will hold round, square or taper-shank drills. The Samson is the kind for you—it's a boon to the "home mechanic."

All Pexto Tools are backed by a century of tool making experience. The line consists of Bit Braces, Hammers, Chisels, Screw Drivers, Hatchets, Snips, Squares, Wrenches, Pliers, Pruning Shears, and many other small tools. It is easy to procure Pexto Tools as they are carried by practically all progressive dealers. Booklets covering our lines are available for free distribution. Ask for them.

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## The Home Workshop

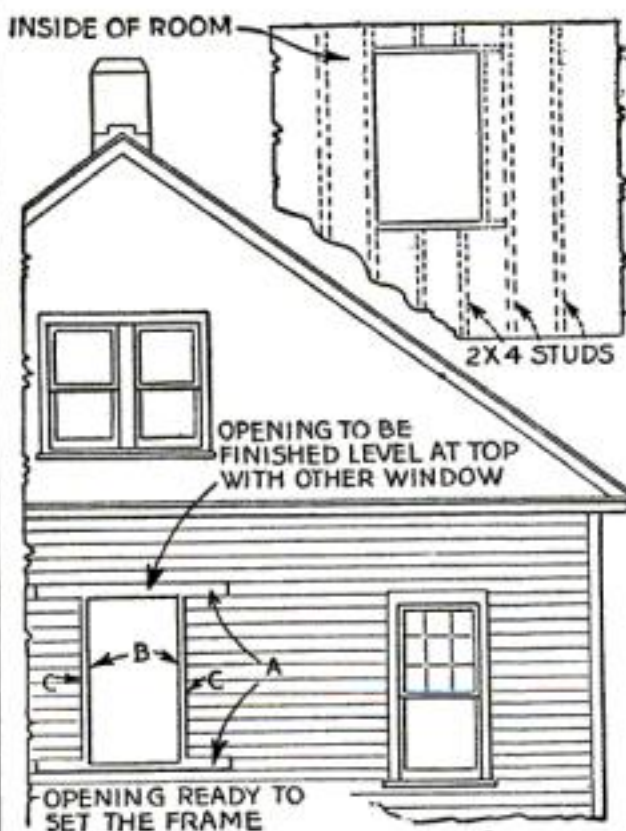
### How to Cut a Window Opening in a Frame House

TO CUT a new window opening in a frame house presents no great obstacle to the skilful home worker.

The location for the window in the room is fixed by the individual circumstances in each case. It remains to be seen, however, if in that position it would injure the appearance of the residence from the outside. This may be judged by measuring from the outside corner of the house, allowing about 6 in. more than the distance across the room or rooms as measured inside.

Should there be a window above or below that comes almost in line with the place for the opening, keep the new window exactly in line, if possible, even if the location is not so desirable on the inside.

If the window is smaller in height than others on that side of the house, it is usu-



Inside and outside view of opening cut and ready for placing a new window frame

ally best to make the new window line up at the top with the others, as illustrated. This brings the window higher from the floor from the inside, but this is not unusual and often no disadvantage.

Before cutting the opening, tap the plastered wall to find the location of the studs or vertical members of the house frame. If by changing the position an inch or so, the cutting out of one side stud can be avoided, do this; it saves much time.

For double-hung sash, that is, the ordinary sliding sash with weights, mark the proposed opening on the wall 6½ in. wider and 5 in. higher than the sash size. For example, if the pair of sash are 2 ft. 6 in. by 5 ft., the opening should be 3 ft. ½ in. by 5 ft. 5 in. If casement sash without weights is used, the allowance in width need be only 2½ in. more than the sash.

Cut out the plaster on the lines with a chisel, breaking out a strip about an inch wide to expose the lath. Then cut through the lath with a coarse compass

(Continued on page 113)

## Tried by a thousand trails



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Carleton Canoes are wonderfully light. They are beautifully balanced, fast and surprisingly easy to handle. And Carleton Canoes are unusually reasonable in price.

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See people and objects miles away just like they were close; see Moon and Stars as never before. Opens over 3 ft. long, 5 sections, brass bound, powerful lenses. Useful and entertaining. Could tell boy arrive at school 2 miles away. "Mrs. Horn. "Read numbers on freight cars mile away, see mountains on moon. "A. G. Palmer. Thousands pleased. Write today; on arrival of Big 3 ft. Wonder Telescope with FREE Carrying Case and Money Strappay Postman only \$1.85 plus a few pennies postage. Satisfaction Guaranteed. FERRY & CO., 3224 N. Halsted St., Dept. 9784, CHICAGO

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## \$25.00 in Prizes

See top of page 8 in front of book for full details



## The Home Workshop

### Pads Protect Your Hands when Lifting Rough Objects

FOR rough, heavy lifting, nothing protects the hands better than the pads illustrated. They are made by cutting from an old inner tube two oval pieces, about the size of dinner plates. In one end of each is cut a slit long enough to admit a hand.

In use, the hands are thrust



through and the pads are pinched between thumbs and forefingers. Besides being inexpensive, they have the added virtue of not making the hands perspire as do gloves.—E. M. L.

### How to Cut a Window Opening

(Continued from page 112)

saw. Also cut out the 2 by 4 in. studs that have to be removed.

You then are ready to work from the outside. Although at times this may be done from a ladder, it is a great advantage to rig up a scaffold opposite the opening to be cut.

It usually will be best to order the window frame, sash, and inside trim complete. When doing this, request that the outside casing be sent loose. The casing then will come tacked lightly to the frame.

Measure the frame with the casing on and mark the opening carefully on the beveled siding of the house with a straight-edge and plumb.

In cutting the opening, the edge of the sheathing (B) should project about 2 in. beyond the edge of the siding (C) and a section of the siding (A) should be removed both at the top and bottom of the frame, to be replaced after the frame is set up. The drip cap on top of the frame should be covered with metal and painted before the upper piece of siding is put in place. At the bottom of the sill a groove will be found into which the bottom piece of the siding fits. Take care to nail the casing very solidly to the wall and frame.

WHEN boring holes in wood without a depth gage, it is possible to have all the holes the same depth by counting the number of turns taken for the first hole and using the same number of turns for all the others.—M. E. S.

# SIMONDS CIRCULAR SAWS

WHEN you specify SIMONDS in ordering a solid tooth circular saw, or any other style of saw, you can be certain that its quality is protected not only by Simonds near-century of experience in making the finest cutting edges of tempered steel, but that constant laboratory tests and development work assure you that your selection represents the very last word in cutting tool manufacture.

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If you can hum a tune you can now learn to play a musical instrument quickly and easily. Think of the pleasure music will bring you. You are always popular and sure of a good time. And there is no easier way to earn money.

### Learning to Play Made Easy

**Free** We now furnish free with every Wurlitzer instrument a Special Scholarship in a nationally famous school of music. This school has taught thousands to play by a special home study method. Many of its graduates are successful professional musicians. Whether you wish to play for pleasure or for profit, choose your favorite instrument and send for this New Offer now! Use the coupon below.

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## The Home Workshop

### Bench Drill Press Made of Pipe and Fittings

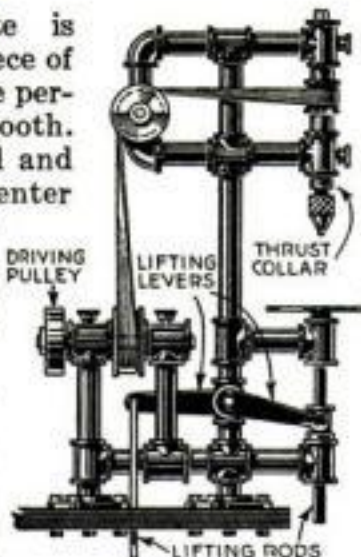
ALTHOUGH made of common pipe fittings and pipe, the small bench drill press illustrated is capable of doing fast and accurate work.

The driving shaft is machined from a piece of cold rolled steel. A thrust collar is located at the chuck end and the end is turned to a Morse taper to suit the chuck to be used. The standard tees used as bearings are rabbitted to suit the shaft and tapped where convenient to receive grease cups.

The faceplate is made from a piece of 1/2-in. steel plate perfectly flat and smooth. A hole is drilled and tapped in the center of plate to fit the end of the lifting rod. The rod is cold-rolled steel.

The lever block in which the end of the lifting lever slides may be either round or square, with flanges on top and bottom. The lifting levers are made from pieces of 1/2-in. flat steel. A square hole in the levers engages a fulcrum shaft, which passes through a pipe cross. A rod is connected with the back lever and passes through a hole in the bench to a treadle underneath. This foot method of feeding the faceplate upward allows both hands to be free.

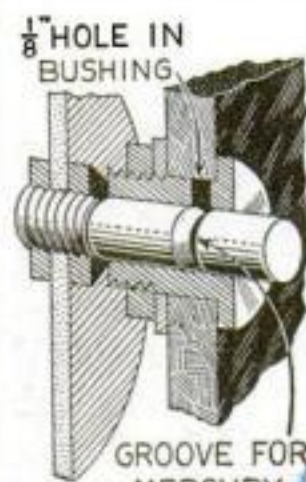
The pulleys are of cast iron. A selection of speeds can be obtained, of course, by using a pair of step pulleys.—F. N. C.



Details of simply made bench

### Mercury Improves Friction Contacts in Radio Parts

TO OVERCOME the tendency of the rotor shafts of radio condensers and couplers to oxidize and cause a loss of efficiency in instruments designed to use



friction contacts instead of "pigtailed," some radio fans who pride themselves upon their neat workmanship use mercury to insure good contacts. The method is illustrated.

A groove about 1/16 in. deep is filed around the shaft so that it will be inside the bushing when assembled. A 1/8-in. hole is drilled in the bushing to coincide with the groove. The shaft and bushing should be absolutely clean. When assembled, the groove is filled with mercury by means of a pipette or medicine dropper. This insures good conduction.—PHILIPPE A. JUDD, Portsmouth, Ohio.

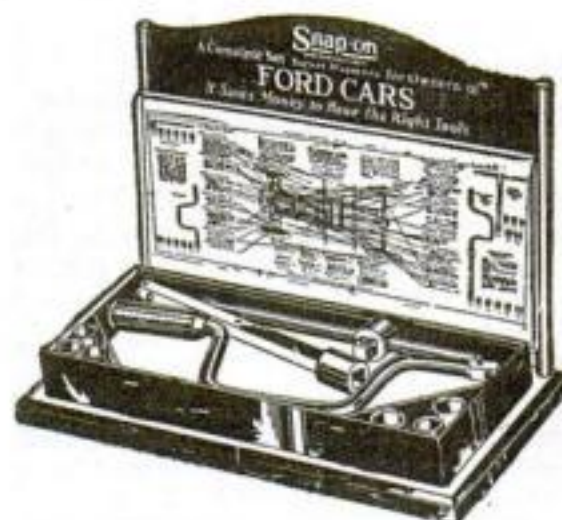


## It Looks Funny

—but it isn't—when you're far from help

VERY likely means an expensive tow-in job—which would cost a whole lot more than a selected Set of Snap-On Wrenches that would always be on hand to help you out of trouble.

Spring is in the air—the open road is calling. Play safe this season—go over your car and tighten up all the nuts and bolts before you start on a trip. It's a quick job with Snap-Ons. Take your Set with you and relieve that gnawing anxiety about road trouble. It will bring a new element of safety that will enhance the pleasure of motoring.



This selected Set for the Ford is equipped with a chart of great value to the owner in making repairs. Ask us about the selected Set for your car.

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Snap-Ons are the choice of over 250,000 garage mechanics. Look for the name—without it no wrench is a genuine Snap-On.

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## The Home Workshop

### Spring Overhauling Lengthens Life of Your Heating Plant

By Orion O. Oakes

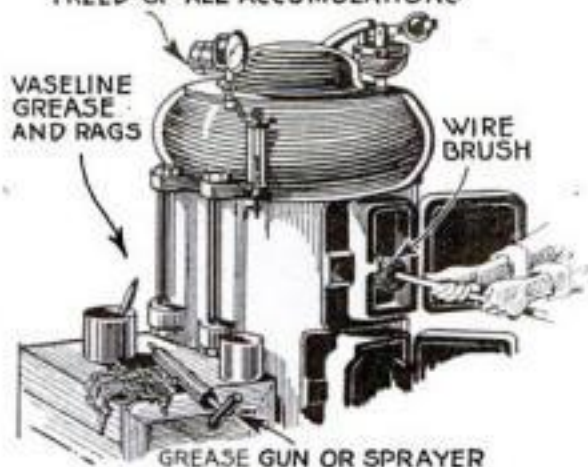
Heating and Ventilating Engineer

AS SOON as fire is no longer needed in the spring, clean out thoroughly all flues and the upper portions of your steam-heating or hot-water boiler with a wire flue brush. Rub all surfaces well to remove soot, ashes, and scale. Part of this material will fall on the grate, part will be drawn out through the various cleanout doors, and part will lodge in the smoke bonnet.

When the flues and upper works are well cleaned, remove all the ashes from the ash pit and clean the pit. The smoke pipe should be removed and scraped with the flue brush, and the smoke bonnet, which now will be accessible, should be freed of all accumulations.

Next obtain a plant sprayer or oil gun and spray all the interior surfaces of the boiler with crude oil or light machine oil.

SMOKE PIPE REMOVED AND BONNET FREED OF ALL ACCUMULATIONS



After being thoroughly cleaned, all metal surfaces are sprayed with oil or greased

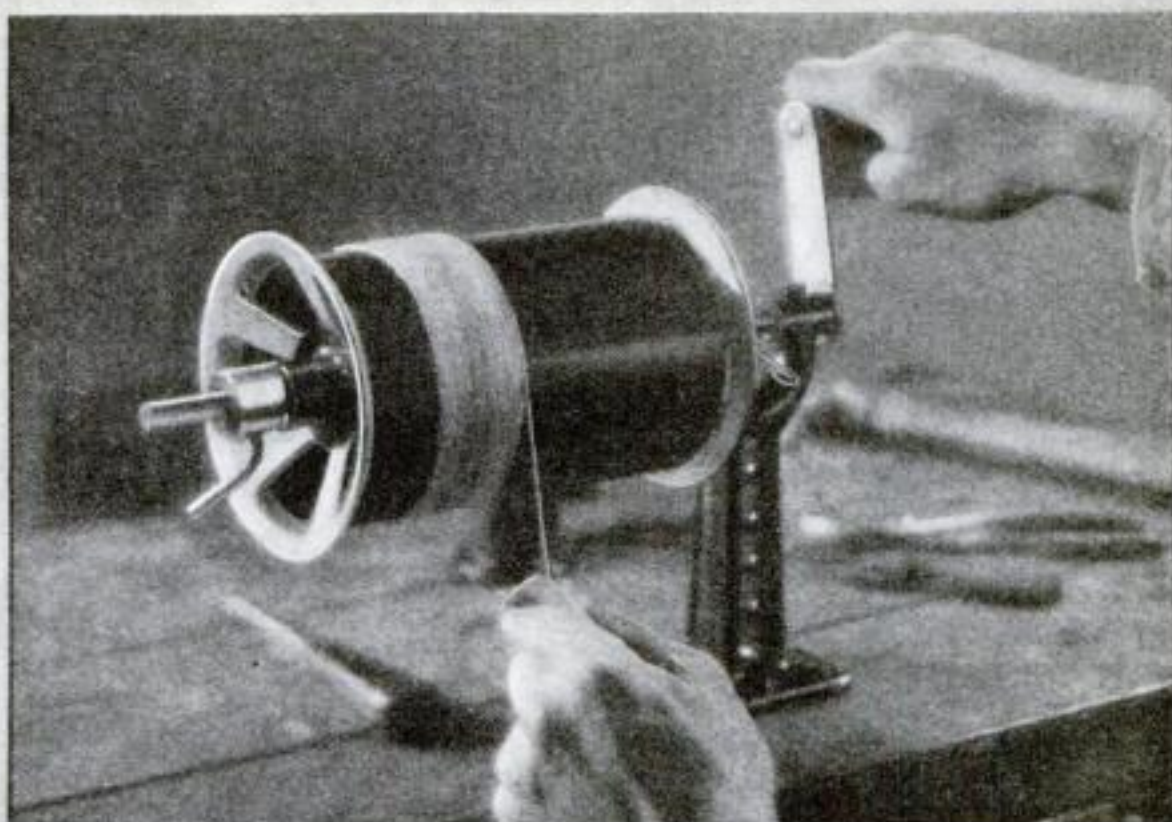
If convenient you may use oil taken from the crankcase of your automobile for this purpose. For the exterior portions use vaseline or a light grade of automobile grease applied with a rag.

The importance of this work is because all flue doors, fire doors, clinker doors, and cleanouts are ground on the edges at the factory to make contact with the frames. When these ground joints are unprotected during the summer, the moisture of the air forms sulphurous acid by combining with soot and this in turn acts on the cast-iron or steel surfaces with a corrosive action. When ready to be used in the fall the doors will be found coated with scale and the hinges and pins may be so affected that the close and accurate contact of the parts is destroyed. The condition becomes worse each succeeding year.

One of the most important requirements for efficient operation of a fire is that all door openings or joints of any kind fit tightly. It will be seen that ill fitting, corroded doors mean poor combustion and loss through fuel waste.

If the boiler is of the metal jacketed type, the entire outer surface should be coated with grease. Treat the smoke pipe in the same manner as the inside of boiler and store it in a dry place if possible.

(Continued on page 116)



## A new tool that radio fans have been waiting for

NOW the radio amateur can "wind his own" as quickly and as expertly as any professional coil winder—and at one-tenth the cost. This Goodell-Pratt Coil Winder is a new tool made especially for winding tubular coils, inductance coils, and transformers for superdyne and neutrodyne circuits.

Holds any cylinder of cardboard, bakelite, or fibre up to  $4\frac{3}{4}$  inches in diameter and 7 inches in length. The outer aluminum driving disc is adjusted to the cylinder length by a sliding collar, which can be locked at any point on the spindle with a thumb screw. The outside face of this collar is cut at an angle, affording a cam action against the button on the disc hub, which exerts a continual tightening effect on the cylinder. And because both discs are cone-shaped, the cylinder is centered automatically.

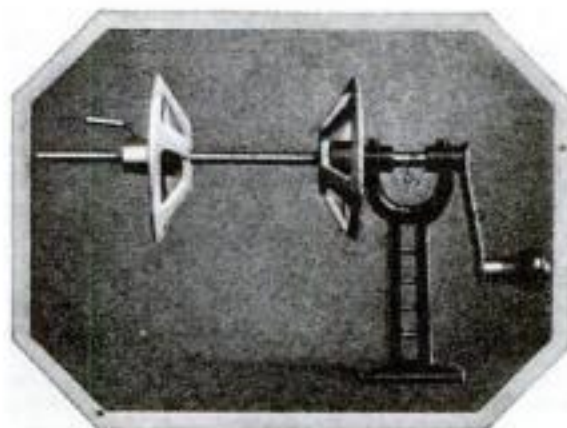
The spring wound around the spindle prevents it from turning backward and releasing the tension on the coil wire. If unwinding becomes necessary, merely raise the loop end of the spring.

Nicely finished in red and black enamel, and natural aluminum, with all exposed steel parts well polished. Length over all  $14\frac{1}{2}$  inches, weight 3 pounds.

**Other tools for radio builders.** Write for special radio tool folders, which show all the Goodell-Pratt radio tools, many of which are new and exclusive Goodell-Pratt inventions.

GOODELL-PRATT COMPANY, Greenfield, Mass., U. S. A.

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No.

695

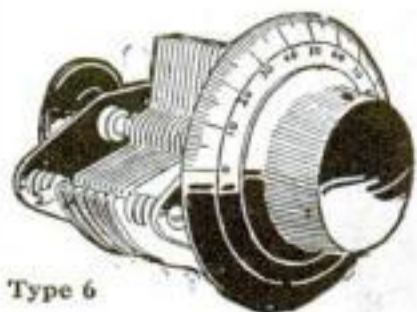
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New 3 H.P. Fast  
LIGHT TWIN

"The Motor that Starts with a Touch"

## The Home Workshop

### Overhauling a Heating Plant

(Continued from page 115)

The boiler should be filled completely by adding water to that already in the boiler and not by emptying and refilling. The water in the boiler has been repeatedly distilled and therefore has less action during summer than new water.

Oil or grease all moving or wearing parts of the pressure regulator and cover, if desired, with an oily cloth to prevent the accumulation of dust through the summer. If there is a thermostat, wipe it and cover with a cloth.

### Biscuit Pans as Receptacles for Small Hardware

ORDINARY 10-cent biscuit pans, painted black with screen enamel to prevent rust, are excellent containers for small hardware, such as screws, nuts, tire valves, and washers. The pans may be



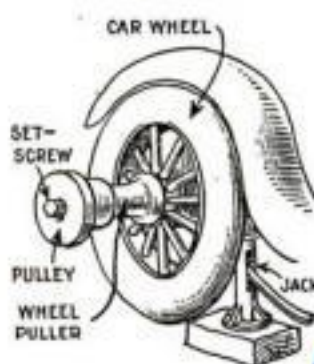
The biscuit pans slide on runners placed under the bench top or under any shelf

hung to the bottom of a shelf or bench on runners bent from 18-gage galvanized sheet iron, or made from  $\frac{1}{8}$  by 1 in. strips of band iron and  $\frac{1}{2}$ -in. square wooden spacers. The runners should be screwed, not nailed, in place.—R. C. T.

### A Large Glue Scraper Made from an Old Hand Saw

A PLAIN wood scraper about 4 by 10 in., made from an old saw, preferably a stiff one, is very handy in knocking off the hardened excess glue from joints preparatory to planing, scraping, and sandpapering large surfaces such as table and counter tops. It does not bruise the surface and is so large that ample elbow grease may be applied.—J. A. H.

### Belt Pulley Fastened to Auto with Ordinary Wheel Puller



WISHING to use my automobile for power purposes, I fastened a pulley to a rear wheel by means of an ordinary wheel puller.

A wooden pulley was sawed out to the right size to give the speed desired. This was fastened to the wheel puller with the setscrew. I jacked up the rear end of the car, screwed the puller on the hub, turned the pulley to a smooth finish, and belted it to a saw.—S. H. S.



## The Home Workshop

### How to Re-Cane Chairs

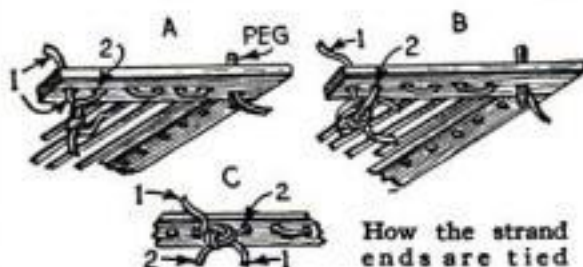
(Continued from page 96)

it in the groove. Then pour more thin, hot glue into the groove, making sure that the entire length is covered and that there is a surplus amount to be forced out as the spline is driven into place.

Take one end of the spline, which has been soaked previously in water to make it pliable, and drive it in at the center of the back rail. Tap it lightly all the way around until it meets in the back. Cut off the surplus with a saw or sharp chisel. While doing this, put a block under the end. Avoid scratching the chair.

With a narrow wedge or a small block of wood, drive the spline down into the groove all the way around until it is flush with the surface of the chair. Wash off the surplus glue carefully with hot water.

After the cane has dried thoroughly, which will take two or three days, it will be as tight as a drum head. If you have been careful to get an even tension on the surface when driving in the wedges, the surface will be entirely free from wrinkles or puckers. The chair now is ready for use, but to make sure that the cane will remain taut in various temperatures, it is well to give both lower and upper



surfaces several coats of good white shellac, after which varnish may be applied.

If the chair you are to cane has no spline and, therefore, has been woven by hand, a different procedure is necessary. The diagrams on the preceding page give the correct method to follow.

Cane for hand weaving may be purchased by the hank of 1000 ft., and comes in various sizes such as fine-fine, fine, medium and coarse. The medium size is used most. You will need about 300 ft. for one chair and about 5 ft. of binding cane.

After removing the old cane by running a sharp knife or chisel across the strands on the bottom and lifting it out from the top, clean up with soap and water and a good stiff brush.

All cane is moistened for not more than three minutes before using. While the diagram explains the steps in caning a square bottom, the method is the same regardless of the shape. If the chair is wider in the front than at the back, count the holes at both places. Say there are 17 in the back and 19 in the front; start your caning from the left rear hole and go to the second hole in the front. If there were 15 holes in the rear rail and 19 in front, you would begin in the left rear hole and go across to the third hole in the front rail. For circular seats the point to keep in mind is to have your cross strands parallel.

Referring to the diagram (page 116), run one end of the cane first through A about 2 in. and hold it with a peg. Run

(Continued on page 118)



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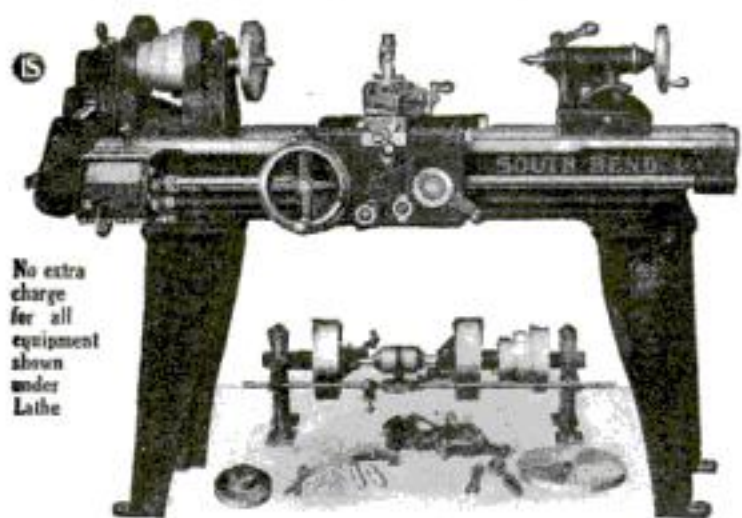
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## The Home Workshop

### Tank for Cheap Sprayer Made from Oil Drum

A STEEL drum such as may be had at low cost from almost any garage, can be made into an efficient sprayer tank for poultry yards, orchards, and gardens.

Pipe fittings with a hose and suitable shut-off nozzle are attached to one of the openings of the drum. Through the cap or plug of the other opening a hole is



A homemade spraying tank for use in the garden, orchard, or poultry yard

drilled to admit an auto tube stem. This stem is attached with suitable gaskets so as to be airtight.

After the drum has been filled with the spraying mixture and placed on a flat wheelbarrow, so that it may be rolled occasionally to keep the mixture agitated, an auto tire pump is connected with it and used to obtain sufficient pressure for spraying.—GEORGE G. McVICKER.

### How to Re-Cane Chairs

(Continued from page 117)

across and down through B, and hold with a second peg. Move the peg each time to insure tightness, but through the whole procedure do not strain.

The diagonals are woven in the fifth step. Start at A and run the strand under the strands woven in the first and third steps and over those of the second and fourth steps. Take great care to follow this order throughout. If the cane does not lie flat and straight, some mistake has been made. Be sure that the cane runs into the squares and not between two strands. Fasten one end (LS) by slipping it under one of the strands on the under side of the chair. Continue as shown, following the holes alphabetically.

In the seventh step lay the binding cane X over the holes and bring the medium cane Y up on one side and down on the other as shown. Keep the medium cane pulled very tightly and when you have gone completely around, tie down the loose end under the last loop.

If the reader of this article happens to be a boy who is anxious to earn a little money, he will find that almost every home in his neighborhood has a chair stored away somewhere that needs to be re-caned. A charge of \$1 for putting in the machine-woven cane and \$2 for the hand-woven will be a very reasonable price, yet, after he has gained experience, it will net a nice little sum in comparison to the labor expended.



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**AGENTS**

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## Home Workshop Chemistry

*Simple Formulas that Will Save Time and Money*

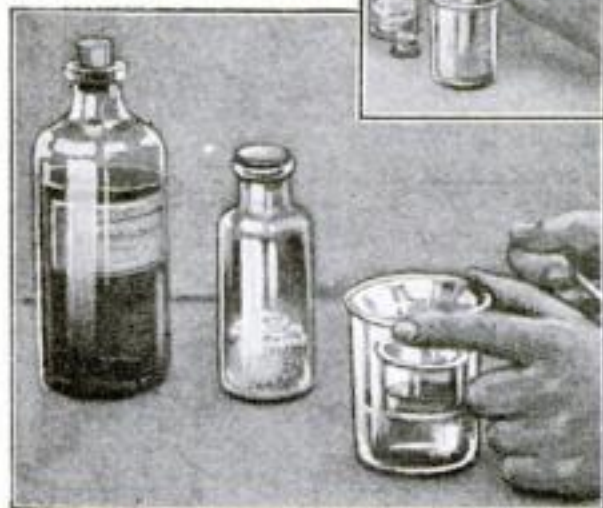
**L**OW temperature can be obtained easily through the use of relatively common chemicals.

Dissolving one part of sodium nitrate in an equal part of water, the quantities being taken by weight, will give an average drop of about 25° C. or 45° F.

Equal quantities of ammonium nitrate and water also can be used. The drop in temperature will vary from 50° F. to about 10° F.

A chemical reaction will serve the same purpose. Eight parts by weight of Glauber salts (sodium sulphate) are used

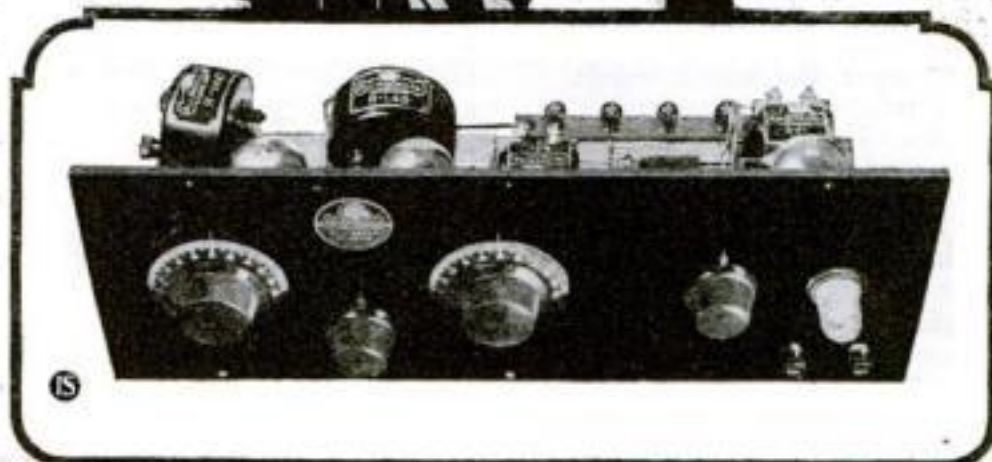
Mixing chemicals to produce a refrigerant (at right) and making ice in the cold mixture (below)



together with five parts by weight of dilute hydrochloric acid, made by pouring the acid slowly into an equal quantity of water and stirring it. Let the acid solution cool before pouring it into the container holding the crystals. A double decomposition takes place and ordinary salt, or sodium chloride is formed together with sulphuric acid.

By this method ice can be made on a small scale. Into a large container, preferably non-metal because of the acid, place the Glauber salts and add the dilute acid. Into a smaller and taller vessel place pure tap water and immerse the vessel in the freezing mixture. In from five to 10 minutes, ice will be formed. It can be used without danger, for the chemicals used in the freezing mixture do not come in contact with the water in the smaller vessel. Other uses for such freezing mixtures will suggest themselves.

Liquids that do not freeze readily also can be prepared. A saturated solution of table salt in water will remain fluid to approximately 0° F. or about 18 degrees below zero on the C. scale. This solution will not corrode or affect the metal parts of an engine. Equal parts of glycerine and water also can be used and it has the advantage of not crystallizing when the water evaporates. In both cases, when the water evaporates, just add pure water.



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## The Home Workshop

### Giving Wings to Your Speedster

(Continued from page 83)

vided. The advantage in removing the magnets and coils lies in reducing the weight about 35 lbs., eliminating the drag of the magnets through the crankcase oil reservoir, and avoiding the magnetic pull.

The brass spools or spacers should be retained on the flywheel so as to splash the oil, unless some additional form of lubrication is added.

The engine flywheel and crankshaft should be balanced accurately on knife edges after these alterations are made. There are several types of supplemental oil-circulating systems from which to choose in order to improve the circulation and insure having sufficient oil in the trough for high speeds. These systems frequently are attached to the engine sump or to the petcock holes in the reservoir. They are connected with a small plunger type of oil pump, driven by the camshaft, which forces the oil to the forward part of the engine.

Another method that has met with considerable success is to shim under-



Another example of a skilfully remodeled speedster incorporating engine refinements

neath the crankcase lower cover reinforcement with sheet metal. This has the effect of increasing the depth of oil in the troughs. Care should be used, however, to see that the large ends of the connecting rods do not strike.

In connection with this method, it is possible to use a 3/8-in. oil-supply tube and to substitute a larger intake funnel adjacent to the flywheel.

To insure an adequate supply of oil for long runs, a desirable arrangement is to place a 1-gal. oil tank in the rear of the car. Connect this with a hand pump within reach of the driver and run a small copper pipe from the pump into the side of the breather pipe of the engine. The oil can be replenished at any time with a few strokes of the plunger.

The grade of lubricant is important. Only the best grade engine oil of high heat resistance should be used. Castor oil is recognized as a dependable lubricant for high temperatures.

As long as a car is driven at moderate speeds, the thermosiphon cooling system is satisfactory. It is too sluggish, however, to combat the increased heat of high-speed operation.

Many water-cooling systems are sold. These are engine-driven and increase the circulation as the speed increases. They

(Continued on page 121)

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## The Home Workshop

### Giving Wings to Your Speedster

(Continued from page 120)

connect either with the inlet or outlet water connections and are gear or belt driven from the fanshaft or the camshaft.

In the selection of a water pump, care should be taken to obtain one that may be fastened securely at several places to the cylinder block and can be relied upon to stay rigid. This is important, especially in regard to the propeller shaft at the packing gland.

With the engine speed in the neighborhood of 2000 r.p.m., the weight of the pistons and connecting rods becomes an important factor. Unless the engine is to be fitted with special aluminum or alloy pistons and light-weight connecting rods, the methods of weight reduction illus-

#### Summary of Alterations that Will Improve Your Speedster

**IGNITION**—Substitute single-spark system or high-tension magneto

**LUBRICATION**—Increase oil-trough supply and add auxiliary oil pump

**COOLING**—Use pump system for circulation

**PISTONS**—Use alloy pistons, or lighten cast-iron pistons by drilling

**CONNECTING RODS**—Drill out webs of the original connecting rods

**CRANKSHAFT BALANCE**—Pistons and connecting rods must be uniformly drilled to maintain equal weight. Balance flywheel exactly, after removing magnets

**VALVES**—Substitute tractor valves  $\frac{1}{4}$  in. larger in diameter

**EXHAUST MUFFLER**—Remove present muffler and install straight tubular exhaust

**WHEELS**—Wire wheels are recommended for flexibility; they also reduce overheating of tires

**GEARS**—Three-to-one, or  $2\frac{3}{4}$ -to-one gears in differential permit of higher car speed, without excessive engine speed

**LUBRICANT**—Only best grades of oil, with high viscosity and flash point, to be used

trated in the drawings on page 83 should be applied.

The weight of the piston is reduced by drilling a series of  $\frac{3}{8}$ -in. holes between the second and bottom ring and also below the bottom ring. In these locations the holes do not noticeably impair the strength of the pistons and are effective in reducing weight and improving the lubrication.

The connecting rod is lightened in the same manner. The smallest hole is  $\frac{5}{16}$  in. in diameter; the other holes increase gradually to  $\frac{1}{2}$  in. They are drilled through the web of the rod.

To improve the lubrication at the big end bearing, it is advisable to drill two  $\frac{1}{8}$ -in. holes into the bearing from above. These conduct a portion of the draining oil on the rod to the bearing.

It is essential that each piston and connecting rod be exactly alike in weight so as to insure balance.

Overhead valve attachments are obtainable for use on the Ford engine. These unquestionably increase the power. It is

(Continued on page 122)



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While you're at it, while you're spending your time and money to be a success, Train for the big-pay Boss jobs in the world's fastest growing industry. The world's work is now being done by Electric power. Autos, ships, buildings, aeroplanes, all electric equipped. Electric lights, everywhere. Think of Radio, Telephones, Telegraph, Electric railways. This business DOUBLED in the last 9 years, and they say it will double again in the next 6 years!

### Mail Coupon at Once

I have a surprise offer for you! Coupon brings complete information, free catalog, my sensational guarantee of a 50% raise, and my confidential surprise offer. Mail it right away!

## Job and RAISE COUPON

Chief Engineer Dunlap, AMERICAN SCHOOL, Dept. E-475 Drexel Ave. & 58th St., Chicago

Send me at once complete information about becoming an Electrical Expert, also guarantee of job and 50% raise, also your confidential SURPRISE offer.

Name \_\_\_\_\_  
St. No. \_\_\_\_\_  
City \_\_\_\_\_  
State \_\_\_\_\_



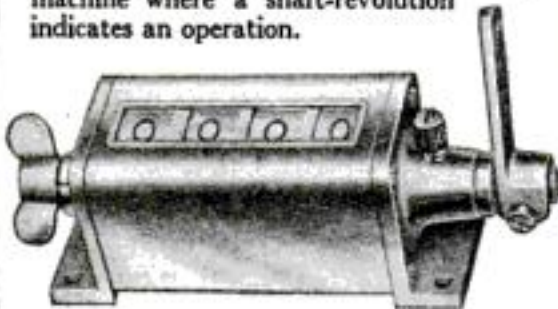
## It's a Race Not a Run!

TODAY'S machines make a *race* of production, not a *run*. From the new design, new speed-gains; new time-savings. How many pieces per minute will it add to the best records yet? Stop-watch and counter give the answer!

How to feed in material—speed out the product—still *faster*? Your experiments, your improvements will tell, and tell *exactly* in the production-records on a

# Veeder

The large Revolution Set-Back Counter below records the output of any machine where a shaft-revolution indicates an operation.



Sets back to zero from any figure by turning knob once round. Supplied with from four to ten figure-wheels, as required. Price with four figure-wheels, as illustrated, \$10.00—subject to discount. *Cut less than one-half size.* Set-Back Rotary Ratchet Counter, to record reciprocating movements as on presses, \$11.50 (list). Smaller counters from \$2.00 up.

### Speed Counter

Here's the handiest instrument for finding revolutions-per-minute of a shaft or flywheel. You hold the tip of the counter against end of revolving shaft; press lightly when the second hand of your watch comes to 0; release pressure when minute is up. A spring clutch controls the recording mechanism.



(Cut less than 1/4 size.)

The Veeder Speed Counter enables you to keep motors, engines, generators, line shafting and machines operating at **efficient speeds**. Price, with two rubber tips (as illustrated) \$3.50.

**FREE**—The 80-page Veeder booklet of counters for all machines and development-work

**The Veeder Mfg. Co.**  
44 Sargeant St., Hartford, Conn.

## The Home Workshop

### Giving Wings to Your Speedster

(Continued from page 121)

possible to improve the engine, however, without this expenditure. Ford-tractor valves can be used in the ports, increasing the valve diameter  $\frac{1}{4}$  in. This amount must be removed from the valve ports; that is, the diameter must be increased  $\frac{1}{4}$  in. For this purpose it is sometimes possible to use a sharp valve-seat reamer, grinding down the reamer to obtain the size. It is obvious that these valves must be ground to a perfect seat.

The back pressure caused by the use of a muffler decreases the engine power and is to be avoided. One successful method of accomplishing this is illustrated. For open road work the cap is removed.

Wire wheels are recommended as representing the most desirable change from the wooden spoke type. These wheels have elasticity and exceptional strength. The heat generated by the tires, especially on hot days, is radiated more readily by these wheels and the tire temperature is kept down.

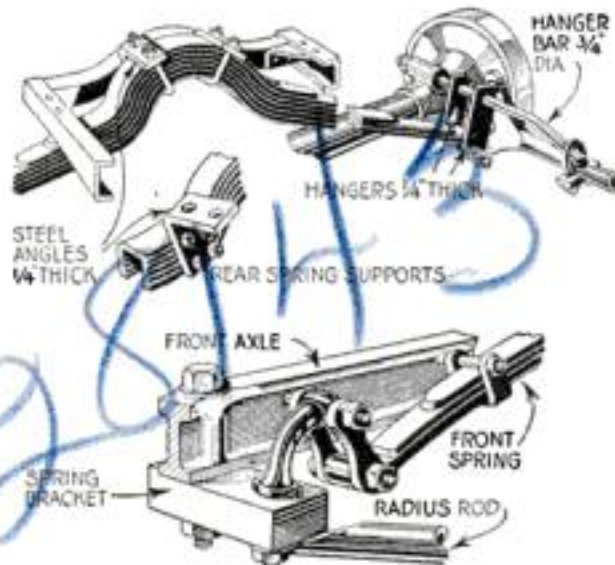
It is advisable to change the drive pinion and ring gear in the differential either to the ratio of 3 to 1 or to the ratio of  $2\frac{3}{4}$  to 1. It hardly pays to make these gears, as they are obtainable at a reasonable cost.

These engine changes are not expensive or difficult to make. They are merely a matter of knowing what to do. The changes suggested embody the result of long experience in making fast cars faster.

A tabulation of the alterations under different headings is given elsewhere to aid you in selecting improvements you wish to adopt and in preparing a list of purchases to be made before undertaking the work of adding speed to your speedster.

### Underslinging a Ford Speedster to Obtain a Racy Appearance

**M**ANY amateur mechanics who have converted their light cars to the speedster type by the removal of the regulation body and the installation of



How the front and rear springs are lowered without making any elaborate alterations

bucket-type seats, large gasoline tank, and rear tool-carrier, are disappointed in the general appearance. The elevated frame seems top heavy.

To lower the frame 2 or 3 in. insures a

(Continued on page 123)

The only belt with the Patented Comfort Feature, which combines absolute comfort, perfect trousers support, and prevents curling and binding at the sides.

## BRAXTON

THE BELT FOR MEN

Handsome Jewelry Buckles. Many beautiful leathers and finishes. At all the best dealers.

The Perkins-Campbell Co.  
New York Cincinnati Chicago

The Very Latest

# Radio Book

Free

This Book Full of Radio Bargains.

Shows Big Savings on parts, sets and accessories.

Our prices are lowest on highest quality standard goods.

Send for your copy today

## HOOK-UPS FREE Many New Circuits

The Barawick Co.  
Dept. 201, 43 So. Clinton St., Chicago

## Stop Using a Truss

**STUART'S PLAPAO-PADS** are different from the truss, being mechanico-chemical applicators made self-adhesive purposely to hold the distended muscles securely in place. No straps, buckles or spring attached—cannot slip, so cannot chafe or press against the pubic bone. Thousands have successfully treated themselves at home without hindrance from work—most obstinate cases conquered. Soft as velvet—easy to apply—inexpensive. Awarded Gold Medal and Grand Prix. Process of recovery is natural, so afterwards no further use for trusses. We prove it by sending Trial of Plapao absolutely **FREE**. Write name on Coupon and send TODAY. **Plapao Co., 790 Stuart Bldg., St. Louis, Mo.**

Name.....  
Address.....  
Return mail will bring Free Trial Plapao

## BLANK CARTRIDGE PISTOL

Protection against Burglars, Thieves, & Dogs

PRICES  
50c.  
\$1.00

POST-PAID

Well made and effective; modeled on latest type of Revolver; appearance alone is enough to scare a burglar. When loaded it may be as effective as a real revolver without danger to life. It takes standard .22 Cal. Blank Cartridges obtainable everywhere. Price 50c. Superior quality \$1.00 Postpaid. Blank Cartridges, by express, 50c per 100.

**Johnson Smith & Co., Dept. 331, Racine, Wis.**

## The Midget "Five-in-One" Slide Rule

is a combination Mannheim, Polymeric, Log-Log, Binary, Add and Subtract Slide Rule. It will instantly add, subtract, multiply and divide any combination of whole numbers, fractions, mixed numbers and decimals. Gives every root and power, also Logs, Sines and Tangents. Made of aluminum with scales on white celluloid. Size 4 in. Approved and adopted by colleges. Price with instructions, \$1.50. Leather Case 50c extra. Sent C.O.D. if desired. Catalogs Free. **GILSON SLIDE RULE CO., Hills, Mich.**

(Patented 1-17-22)



## The Home Workshop

### Underslinging a Ford Speedster

(Continued from page 122)

racier appearance, steadies the car, and allows the wheels to hug the road when making turns at high speeds. In the accompanying illustration a method of accomplishing all this is shown.

The supports for lowering the rear spring are made from  $\frac{1}{4}$ -in. plate, rectangular in shape and drilled each end. A rod at each side passes through the plates. One end of the rod is fastened to the regular spring hanger; the other extends to the radius rod, where it is held as shown.

When the spring is placed in the lower position, it is necessary to use angle plates as a support in the center.

The lowering at the front of the frame is accomplished by moving the axle forward and making a bracket of rectangular section, with two holes drilled through each, to support the spring. The forward hole of each bracket is engaged by a bolt through the axle where the spring perch previously was located. The rear hole is used for fastening the spring perch above the bracket and the radius rod below the bracket as detailed.

The moving of the front axle forward also lengthens the wheel base. This is desirable, as it increases the steadiness with which the car holds the road.

In fitting the forward bracket, the builder should make the upstanding lip, shown on the bracket, bear against the axle. This is to insure perfect lateral rigidity of the front axle. Inexpensive front radius rod braces are obtainable, their use depending upon the distance the spring is moved to the rear.

### Reforging Front Axle Lowers Car's Center of Gravity



ONE ingenious amateur mechanic who was converting his light car into a speedster, lowered the center of gravity several inches by having the front axle reformed as shown. This was accomplished without altering any essential details or the steering method.

### Remodeled "Flivver" Does 94 Miles an Hour on Beach



WHAT a remodeled Ford can do was shown when this car ran at 94 miles an hour on Muriwai Beach, New Zealand. It is owned by Stanley and Ivan Andrew, of Auckland.



## Sure I'll Fix It!

NOTHING could be simpler with these Klein Pliers. Fact is, I'm glad to get my hands on them again. I guess every man feels that way about good tools.

Yes sir, most men *do* feel that way. That's one reason why Klein Pliers have been the favorites for 68 years. You'll notice that most hardware stores feature them. Electrical companies *specify* them! Treat yourself to a pair today.

Mathias **KLEIN** & Sons  
Established 1857 Chicago, U.S.A.



DID you ever look the tube question square in the face? Ever stop to realize that the vacuum tube will make or break your receiving set as far as good results are concerned?

Give your set a fair chance to bring in the distant programs. Resolve now that a good set deserves good tubes and decide on MAGNATRONs. The results will pleasantly surprise you.

MAGNATRONs know no superiors. And yet the MAGNATRON DC-201A, the MAGNATRON DC-199, and the MAGNATRON DC-199 with large base sell for only \$3 each, at your dealer's.

Connewey Electric Laboratories  
New York, N. Y.—Manufacturers



# MAGNATRONs





## We've mapped the air for Radio explorers!

Get your copy of this great new map to-day

**T**WIST the dials until you catch a faint hum. Nurse it carefully and it becomes a murmur of distant music. Then a moment of silence. "This is station KFAF, Denver"—and you add another station to your list.

But how far away was it? What sort of country did the message flash over? You want to visualize your exploit and mark it for future reference.

You can—with the New Collier Radio Map of the United States and Canada. It's beautifully printed in three colors. Every station is clearly marked and the time zones outlined.

Instantly you can tell how many miles away a station is. Cut out the scale of miles provided and paste it on cardboard. Put a pin through one end at the point where you are located. Swing the other end across the country until you reach the station you are after.

Here are some more points worth noting:

1. If you use a directional aerial, you can pick out any station you want to get on the map, and point the loop towards the exact point where the station is located.
2. Around the map there is an alphabetical list of all stations which also gives the name of the operator of each. If you miss the letters given by an announcer, you often catch the name of the operator of a station which can then be located by referring to the index.
3. The map outlines the boundaries of the radio districts, identifying them by number. This will be a help in locating amateur stations.

There's a lot of satisfaction in radio exploring with this great new map. And it costs only a quarter. Get your copy at your newsstand, bookstore or radio dealer's tonight. Or just mail 25c in coin or stamps with your name and address to us direct.

**P. F. COLLIER & SON CO.**  
Dept. R.M. 250 Park Avenue  
NEW YORK CITY

## The Shipshape Home



### Repairing a Porch Column

THE high cost of lumber has led to the use of much wood for the exterior woodwork of modern houses that does not last very well. For that reason the home worker often finds it necessary to repair porch steps as described last month, or even to patch porch columns.

If a column has rotted away at the bottom, break off a piece of the base molding and base block to allow you to measure the exact size of the block and the diameter of the column. Also find the length of the new base and short length of column required to replace the decayed portion.

Have a woodturner make the new section of the column unless you yourself have access to a lathe large enough for the work. Be careful to have it made a trifle larger rather than smaller than the old.

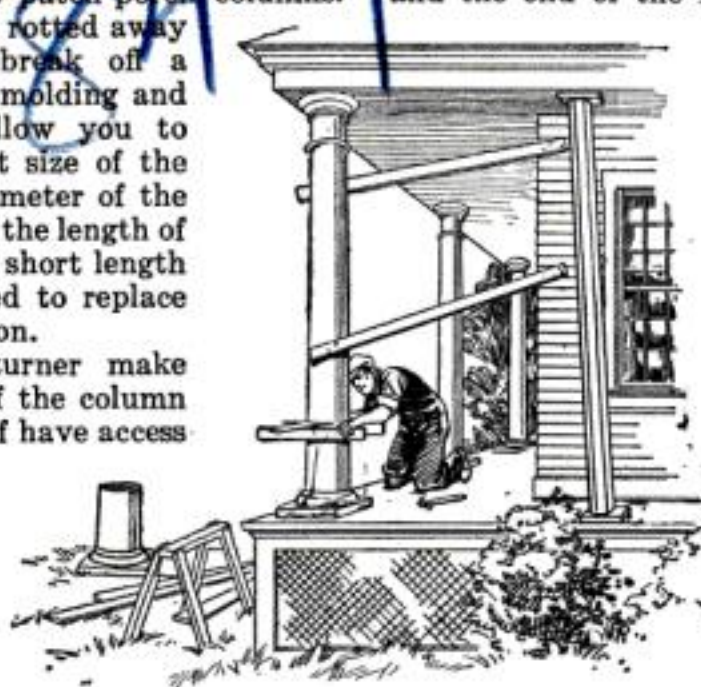
If it should be smaller, a neat repair could not be made, but if it is a trifle larger, it is easy to pare and sandpaper the joint down and make a workmanlike job. It will be necessary to prop up the porch roof with a strut, as illustrated, to take the weight off the column. One or two braces may be nailed from the house

to the column to keep it plumb when it is being cut.

Measure exactly the combined height of the base block and short length of column and mark where the old column is to be cut. Nail on the column two strips to guide the saw, as shown; they must be quite level. If your saw is sharp and fine and the end of the new piece of post is

turned true, the joint should require no fitting. The base block, however, will have to be fitted to the bevel of the porch floor, although this may be but a trifle.

Repair the porch floor under the column, if decayed, and paint all joints before putting the new work in place. Only a few wire finishing nails are required to hold the new base in place.—A. E. E.



Sawing out the decayed base of a porch column before inserting a new piece

When a stone or sharpening steel is not at hand, a knife may be brought to a keen edge by drawing it over the back or upper edge of a hacksaw. The hacksaw blade, which should be of the common type that is hardened throughout, must be held taut in its frame.—T. G. L.

### Holder for Razor Blades

NOT the least of the many small and sometimes annoying problems met by a busy housewife is to find a safe way to dispose of used razor blades. She dare not throw them away, for bare little feet may find them. From bitter experience I found it unsafe to put them in the trash to be burned.

Nearly at my wits' end, I finally thought of cutting a slit large enough to admit a blade in the top of a used evaporated-milk can. The sharp edges are turned in and the can is enameled white. Once inside, the blades are beyond causing an accident. —MARGARET CRAGO, Louisville, Ky.



### Renewing Pump-Valves

FIVE years ago a pump used in connection with a rather deep cistern failed to raise water. I found the leather valves were worn out.

Having to make a temporary repair at once, I peeled three layers from the inside of an old auto tire, placed them under a weight overnight to flatten them out, and the next morning made valves from them. They are doing service yet. The service they have given already is more than might be expected from the best quality of leather valves, so that this type of repair can be recommended, especially

as pumps often give out at a time when it is impossible to wait for regular valves. —F. X. ALLEN, Del Rio, Tex.



## The Shipshape Home

### Table-Leaf Closet

ONE great aid in keeping a home shipshape is a convenient place to store away the extra leaf or leaves for the dining-room table. A closet for this purpose usually can be built into the wall in the kitchen entry, hallway, or elsewhere. To make such a closet, find out by tapping the plaster or wallboard where two



of the studs or upright supports are located and then cut out the wall between them from the baseboard up to a height 1 in. more than the length of the table leaves. Make a rectangular box to fit the opening, using  $\frac{3}{4}$ -in. sides and ends and a sheet of iron or tin for the back. Nail this in place in the opening and finish either with trim to match the other woodwork in the room, or with any small molding that is at hand or can be obtained easily.

The table leaves are held in place in the cupboard by dropping a rod with two down-turned ends into screweyes placed in each side of the cupboard.—T. F. WAIT, Storm Lake, Ia.

### Paste for Stopping Leaks

A PUTTY-LIKE mixture of oxide of iron, coal tar, and boiled linseed oil may be used in repairing leaky gutters, water tanks, iceboxes, and the like. Several layers of cloth strips coated with this mixture make a good emergency substitute for a soldered sheet-metal patch.

### Dollars for Ideas

IN KEEPING your home shipshape, you often hit upon ingenious, time-saving, labor-saving and money-saving ideas.

If you will describe, in not more than 200 words, each of your ingenious keeping-the-home-shipshape methods, we will pay \$2 for every one published. Include a pencil sketch or photograph to illustrate the idea, if possible, and address your letter to the Home Workshop Editor, POPULAR SCIENCE MONTHLY, 250 Fourth Avenue, New York.



A set anyone can put together and enjoy all-the-year-'round radio



Directions given so simply that anyone can follow them

ABOVE are illustrated the circular of printed instructions and the life-size diagrams of the wiring, which are packed with each Model "S" Kitset. Step by step the making of the set is described in clear, simple language—just simple operations which anyone can easily follow.



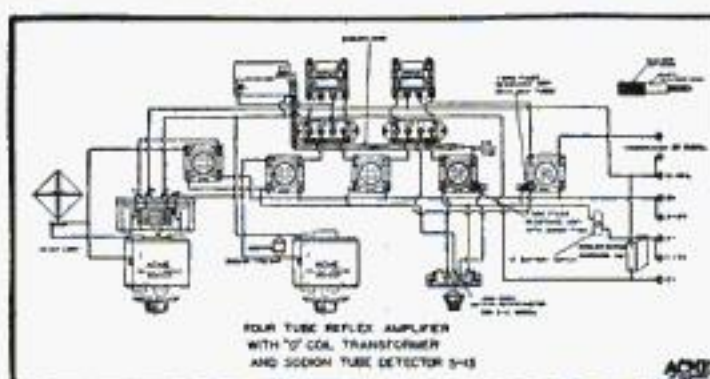
Only two tools required—a screwdriver and pliers—and they are included in the kit.

### Enthusiastic praise from Model "S" user

From Hartford, Conn.: "Just finished it tonight. It's a wonder. Finest we ever heard. Congratulations for your wonderful engineering."

# ACME

~ for amplification



This is the new Model "S" Acmeflex Kitset

IN THE above wiring diagram special attention is called to the D-Coil radio frequency tuning unit and the vacuum tube detector, giving the famous Acme Reflex (trademark) still greater distance, greater selectivity and better reception.

## We can save you about \$60.00 on this \$150.00 radio

IF YOU bought this set completely assembled it would cost you \$150. But by putting it together yourself you can buy it for only \$80, plus cabinet, saving about \$60. We could make it for less but it wouldn't give results.

Acme Engineers have done all the engineering for you and have written clear, simple directions which show you, step by step, how to put the set together. Many have done it in three hours, and found it fascinating fun. Even if you know nothing about radio you can put it together. All the parts are in the kitset, even the loop. No antenna to erect. Even a screwdriver and pair of pliers, the only tools you need, are included. No soldering to do. The panel is all drilled for you. The only accessories to buy are tubes, batteries, loudspeaker and cabinet.

And your finished set is the famous Acme Reflex (trademark) now wonderfully improved in distance, selectivity and reception. It will pull in distant stations loud and clear on a loop and loud speaker. Compare results with other sets of six to eight tubes. Only one tuning dial—easy to tune. Send coupon today for complete information. Lots of amateurs have built up a nice business putting together these sets for their friends.

### Note these features of Model "S" Acmeflex Kitset

Complete directions given for putting set together. No antenna to erect. No technical knowledge or workshop required. Only two tools and they are in the kit. No soldering to do. Only one tuning dial. Excellent reproduction. Greater distance, sensitivity and selectivity. Non-radiating—won't bother your neighbor. Saves you about \$60.00.

ACME APPARATUS COMPANY,  
Dept. P-1, Cambridge, Mass.  
Pioneer Radio and Transformer Engineers and Manufacturers

ACME APPARATUS COMPANY  
Dept. P-1, Cambridge, Mass.  
Send complete information about the new Model "S" Acmeflex Kitset to:  
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Street.....  
City.....State.....

10 DAYS FREE TRIAL - MONEY BACK IF NOT SATISFIED

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### The Perfect Writing Instrument

Writes with ink free and easy as a lead pencil, without a miss, skip or blur. Its steady uniform flow of ink actually improves your hand writing. Won't blot, scratch, leak, or soil hands.

Makes 3 or 4 Carbon Copies With Original In Ink. Anyone can write with your Inkograph, no style of writing or pressure can bend, spread, injure or distort the 14 kt. gold point.

Patent Automatic 14 kt. gold feed prevents clogging. Made of best grade, highly polished, hard rubber, highest class workmanship. Pocket clip attached makes it an instrument of refinement. You'll never use a fountain pen once you try an Inkograph. No complicated mechanism to clean or get out of order. SEND NO MONEY. Pay postman \$1.50 plus postage. Year's guarantee certificate assures absolute satisfaction. Write name and address plainly.

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ACTUAL SIZE 6 1/2" LONG AGENTS WANTED

The Writing Hemisphere

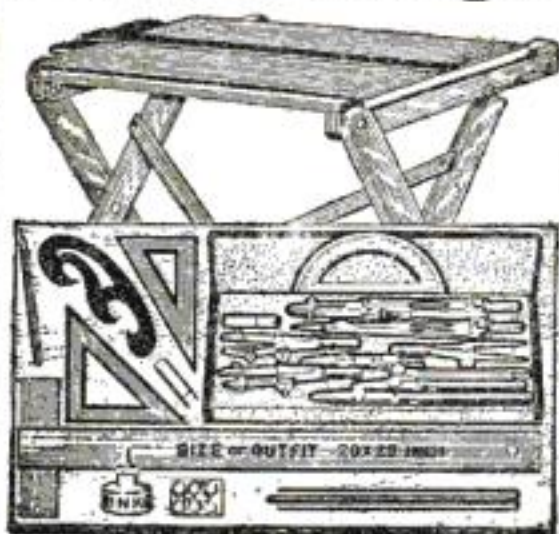
The INKOGRAPH ACCOMPLISHMENT

That hard smooth round ball like point, which glides with ease over the coarsest paper and makes possible writing in ink as rapidly as with the softest lead pencil.

1.50



## All These Included No Extra Charge



### Mail Coupon Below

Complete Set of Drawing Instruments sent as soon as you enroll. You get a 20x25 inch drawing board, a 24-inch T square, a 12-inch rule, a supply of drawing paper, two triangles, a French curve, pencils, erasers and thumb tacks. They would cost approximately \$23.00 at any retail store but I include them in my course without extra charge.

### The Trained Draftsman Earns a Good Salary

There is always a demand for skilled draftsmen. Companies are issuing calls every day for men to fill positions paying good salaries. Work is light, pleasant and profitable; a trained draftsman can be reasonably sure of having a good job all the time.



### I Guarantee

to train you on practical work under personal supervision until competent as a regular draftsman, and guarantee, further, to furnish you with draftsman's complete working outfit, a special "Chief's Own" drafting table, and all the instruments you need, just as soon as you become my student—all to be included in the course without extra charge.

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I am a practical Chief Draftsman. I have been doing drafting work for a quarter of a century and I know just the kind of training that is demanded from men who get big salaries. I train you by giving you actual, practical work, the kind you must be able to do to hold a permanent position.

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In addition to my other offers, I have made arrangements whereby you may earn a regular \$90 drafting course while you are my student. I want to do everything possible to prepare draftsmen for the urgent calls now being made for them, by offering every inducement to ambitious men anxious to succeed in a big way. Big companies issue calls every day for skilled draftsmen to fill good paying positions. A trained man can be reasonably sure of a good job all the time. He can supplement his salary by extremely well paying home work. Write for details.

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## Better Shop Methods

(Continued from page 88)

### Using an Electric Drill in a Planer

*A portable tool is clamped to the clapper block to do the work of a big radial drill*

By William G. J. Thompson

RECENTLY in the shop where I am employed, a 1200-lb. cast iron roll about 6 in. in diameter and 10 ft. 6 in. long, had to be drilled. It had 11 grooves, in each of which 15 holes were to be drilled and tapped. If a radial drill and chain block had been available, this might not have been much of a problem, but all the regular drill presses were in such a position that a chain block could not be hung in a convenient place to take the weight of the casting.

The foreman was about ready to use one of the drill presses and about 6 or 8 men to move the roll, when I thought of adapting a big planer as a drill press.

Getting an electric drill from the tool crib, I found that I could unscrew one of the handles and make a holder for the drill that could be clamped in the planer. The foreman, when he heard my suggestion, told me to do whatever was necessary.

I obtained a piece of 1½-in.-square stock 9 in. long, and had the blacksmith bend it to form a right angle, one leg 7½ in. long and the other leg 1½ in. I centered the short end and turned and threaded it to fit the tapped hole in the

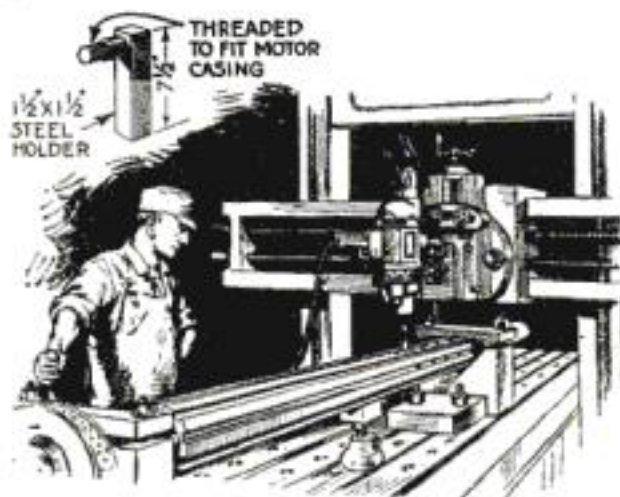
drill motor casing. Then I screwed the holder into the casing and, finding it was not in line with the drill, I squared off the shoulder of the holder until it was exactly parallel to the motor.

After clamping it to the clapper block of the planer, I found that when the drill was fed into the work, the clapper block would swing out because the drill was ahead of the center of the clapper box.

To overcome this difficulty, I locked the clapper block in the clapper box by drilling a hole in the clapper box and tapping it for a setscrew. I spotted the clapper block with the drill point to allow the setscrew point to hold firmly.

Then I set the drill up and shimmed it until it was perfectly straight both ways. I locked the clapper block with

the setscrew and moved the planer until the first hole was in line with the point of the drill. After drilling this hole, I indexed the next groove and drilled the second hole, continuing until the first row of holes had been drilled around the roll. Then I moved to the second row of holes and did likewise until the entire 165 holes were drilled. The saving of time and money was considerably over any other method that might have been used.

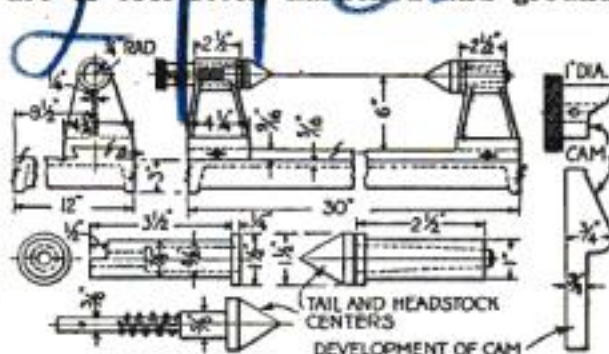


Drilling a large grooved roll with a portable electric drill fastened in a planer

### Bench Testing Centers

THE bench centers shown below are designed for use in the toolroom for laying out and testing work. The tool can be made at small expense.

The base is of cast iron and the centers are of tool steel hardened and ground.



Details of the centers. One pattern serves for both headstock and tailstock castings

One pattern will do for both the headstock and tailstock castings.

The slideway runs the entire length of the base. The tailstock and headstock, each of which is provided with a gib, can be set quickly any distance apart and held with thumbscrews.

All of the machine work should be done carefully, and for very accurate work the top surface of the base should be scraped. Both centers should be exactly the same height and precisely parallel with the slide and top of base.

A cam withdraws the tail center from the work with a half turn to the right. A coiled spring returns the center to its position with another half turn of the knurled handle.

### Double-Acting Machine Clamp

FOR machining a large number of straight edges ¾ by 1¾ by 24 in., the writer had a double-acting clamping fixture made as shown.



The work-holding casting is 25 in. long, provided with one clamp at the center and two others about 3 in. from each end. Much hard work in setting and blocking up often can be saved by the use of a clamp of this kind.—F. N. C.



## Better Shop Methods

### Old Bill Says—

SOME of our customers will spend \$100 repairing an old machine that is worth only \$10 as junk.

What economy is there in repairing a worn or broken part or replacing an old machine that can be replaced by a new one for the same or, as often happens, less cost?

Be sure to use a handle on a file when filing in a lathe.

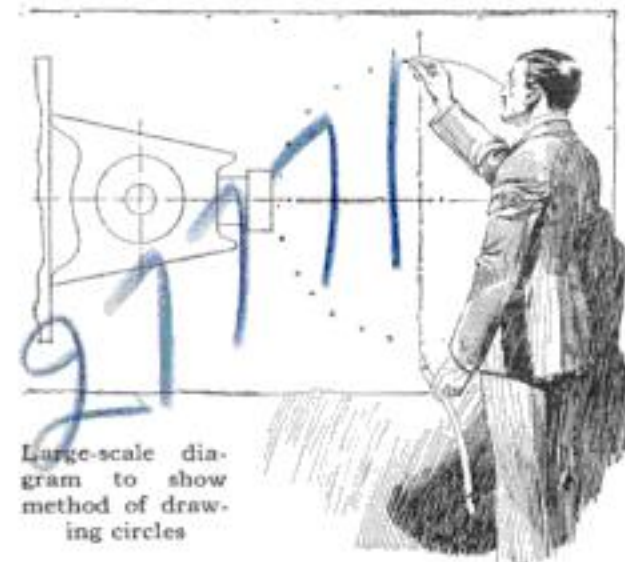
To be a good mechanic requires a constant struggle against slipshod methods, but half the battle is to have plenty of enthusiasm for work.

Vinegar is a wonderful help in loosening a rusted screw.

When you knock your shop, you knock yourself. If things never are going to suit you, why not get out?

When using a toolpost grinder, always protect the ways and bearings from grit by spreading an old newspaper or cloth under the wheel.

### How to Draw Accurate Freehand Circles on Shop Sketches



EVEN experienced draftsmen often make sadly misshaped circles on their freehand sketches. They are especially apt to do so when they go into the shop to draw details, because usually they have not their drafting instruments.

Circles can be drawn quite easily, however, without any other aids than the sketch pad and the pencil. Tear off a strip of paper a little longer than the radius of the circle and on it check two points to limit the center and circumference to be drawn. Hold one point on the center and mark several points at intervals around the circumference as shown. With these guides the circle can be filled in accurately.—FRANK W. BENTLEY.



Old Bill, machine-shop foreman

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**BE A "WHITE-COLLAR" MAN—  
Earn \$90 to \$150 a Week—CLEAN Money!**

What's the use of doing dirty, greasy, *hard* work, when you can *NOW* make *TWICE* as much money in a manly profession that is *CLEAN*, profitable and full of opportunities?

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## The pipe-tobacco case is closed for Mr. G. E. M.

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I find it to be the only tobacco giving me complete satisfaction. It certainly is a pleasure to smoke a tobacco with a pleasant taste, which at the same time does not bite the tongue. I have tried many brands of tobacco recommended by friends, but have only been able to enjoy one tobacco thoroughly, Edgeworth. Now I take tips on good tobaccos from no one, as I am satisfied in my own mind that there is no better tobacco sold than Edgeworth.

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Yours sincerely,

G. E. M.,  
Los Angeles, California.

Which proves again that tobacco taste is an individual matter. Two friends may agree on the merits of a book, a play, or almost anything—and at the same time be as far apart as the north and the south poles on their opinions of a tobacco.



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Edgeworth is sold in various sizes to suit the needs and means of all purchasers. Both Edgeworth Plug Slice and Edgeworth Ready-Rubbed are packed in small, pocket-size packages, in handsome humidor holders holding a pound, and also in several handy in-between sizes.

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## Better Shop Methods

### How You Can Earn Money for Photos of Ingenious Tools

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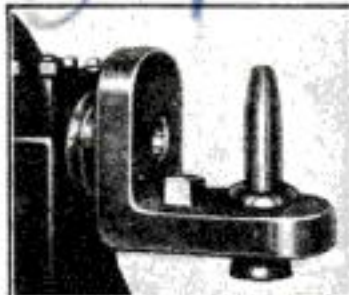
If you are a mechanic, no doubt you have made at some time or other an especially useful or unusual tool or fixture to accomplish work that could not be done so easily with your regular tools. The chances are there was nothing on the market you could buy to serve the purpose of the tool you made, and, although it may have given service only on a few occasions, it probably paid for itself many times.

If you have made such a tool, send a clear photograph of it, with a brief description of its construction and purpose, to the Editor, Better Shop Methods Department, POPULAR SCIENCE MONTHLY, 250 Fourth Avenue, New York. For each photograph available for publication, POPULAR SCIENCE MONTHLY will pay \$4.

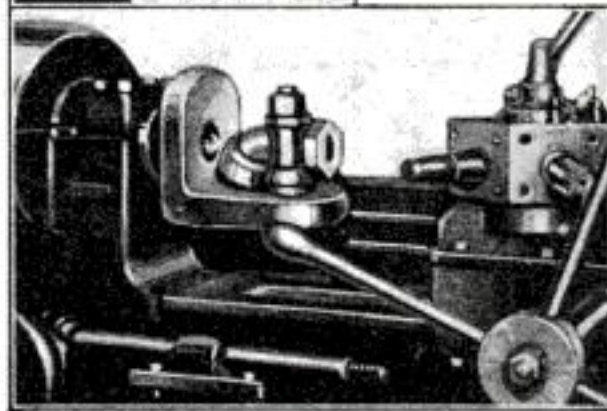
### Jig for Angle Cock

BY USING the jig illustrated, I can machine an angle cock completely in four minutes. The jig is used in centering, boring, reaming, counterboring, and tapping angle cocks used on airbrake equipment.

The reason the angle cocks are bored is because the threads are worn or broken



A simple fixture to hold airbrake angle cocks while machining them in a turret lathe. It increased production more than 50 per cent.



off after some service and it is necessary to bore them out to 1 23/32 in. and thread with 1 1/2-in. pipe tap in order to screw in a 1 1/2 by 1 1/4 in. bushing.

The work was first done in a drill press, but so much time was lost changing tools that I had this jig forged out. It increased my production more than 50 per cent.—ARCHIE SKINNER, Chicago, Ill.

### Building Brick Polishes Cast Iron

FOR smoothing and polishing the meeting surfaces of cast-iron doors and hand-hole covers, an ordinary brick is unsurpassed. It evens up depressions and projections. Ammonia leakages in one case were decreased by its use more than by any other method of smoothing the doors.



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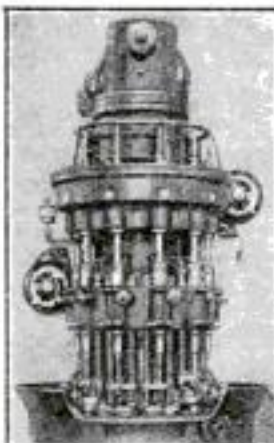
## Better Shop Methods

### New 10-Spindle Drilling Machine Operates Continuously

THE new 10-spindle continuous rotary drilling machine illustrated was designed and built for drilling holes  $\frac{1}{2}$  in. in diameter and 1 in. deep in collar hexagon nuts used on automobile disk wheels. It is adaptable, however, for drilling other parts of a similar kind.

Machinists used to an ordinary drill press will be particularly interested in this machine because of the amount of work it handles. The cold pressed hexagon blanks for the nuts mentioned, which are 10-point steel screw stock, are turned out at the rate of 35 nuts a minute.

The machine con-



The operator merely has to slip a blank into each work-holding fixture as it passes by

sists of a stationary round post mounted on a base. A circular carrier supports 10 drilling spindles with their respective work tables and actuating mechanism, all of which revolve around the base.

The cutting feed to the work table is obtained by a cam mechanism timed to give the operator an opportunity to load. The locating and holding of the nuts is automatic. All the operator has to do is to slide a blank nut approximately into position in each of the fixtures as it passes by. The ejecting of the nuts is automatic.

### Copper Tool Used as Indicator

IN TRUING up pulleys, shafts, studs, or other finished work in a lathe when no indicator is available, a copper tool may be used. The tool should be ground to a diamond point.

Tighten the tool or tool holder in the toolpost and run the copper point against the revolving work until it touches the high spot. Then adjust the work until it shows a copperish line of even width all around.—W. J. T.



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## Better Shop Methods

### Lathe Shortcuts that Save a Machinist's Time

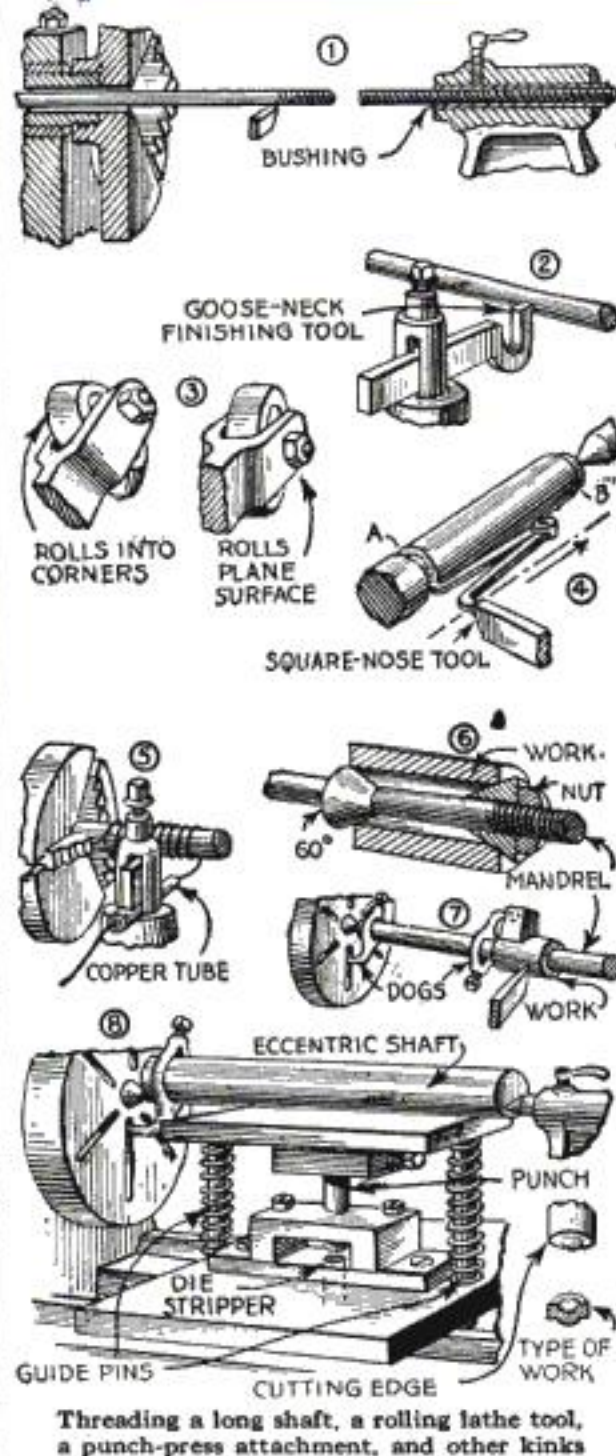
By F. J. Wilhelm



**T**HERE are many simple little tricks in lathe work that a machinist can use on occasion to cut down materially the time required in machining certain jobs. A few of those I have found useful in my own work are described below and they will suggest a number of others to any alert mechanic.

A job too long to be finished between centers, such as turning a long shaft or cutting the thread on a long lead screw, may be handled as shown in Fig. 1. Make a bushing to fit the spindle hole in the tailstock, the inside diameter a nice running fit for the shaft or screw. The first section, which will be limited by the dis-

(Continued on page 131)



Threading a long shaft, a rolling lathe tool, a punch-press attachment, and other kinks

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Philadelphia, Pa. Dept. 1929, Kansas City, Mo.

## Better Shop Methods

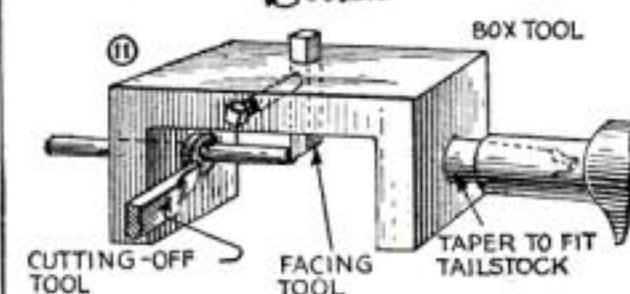
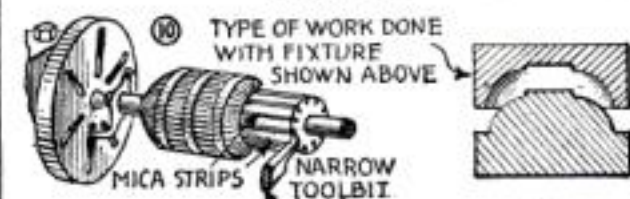
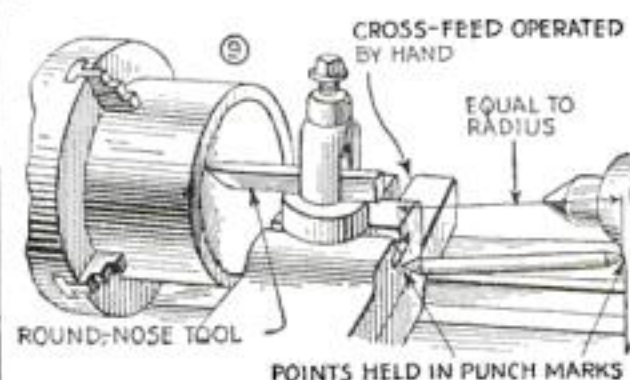
### Lathe Shortcuts that Save a Machinist's Time

(Continued from page 130)

tance between centers, is machined with the center in place in the usual way and driven with the chuck.

When this is completed, remove the tailstock spindle and insert the bushing, which is to be used as a steady rest bearing and center. Move the screw or shaft along through this bushing and through the hollow spindle of the headstock for a sufficient distance to allow another section to be turned. If a thread is being cut, have enough of the thread remain outside the bushing to start the new cut. This operation is repeated as necessary.

In cutting a square or acme thread, a great deal of time may be saved by the



Turning a spherical surface, truing a commutator, and using a box tool for small pins

use of two tools. First, rough out the thread with a tool that is 1/32 to 1/16 in. narrower than the finished size of thread. Then follow with the finishing tool. This method avoids tool breakage and stopping to grind the tool, as very little stock is left for the finishing tool to remove. It also speeds up the work noticeably.

The tool shown in Fig. 2 leaves an excellent finish when turning long shafts with a light cut and coarse feed; practically no filing will be necessary. Grind the cutting edge as for regular square-nosed finishing tools. If water is allowed to drip on the point of tool while in use, the finish will be improved, but the work should be smeared with oil afterwards to prevent rust.

Another style of tool suitable for finishing heavy shafts and similar jobs is shown in Fig. 3. A holder carries a hardened steel roller, which is brought to bear against the work with considerable pressure in the same manner as a knurling tool. The finish is rolled on.

A good method for setting the lathe accurately for turning a taper, when it is not equipped with a taper attachment, is

(Continued on page 132)



RMA



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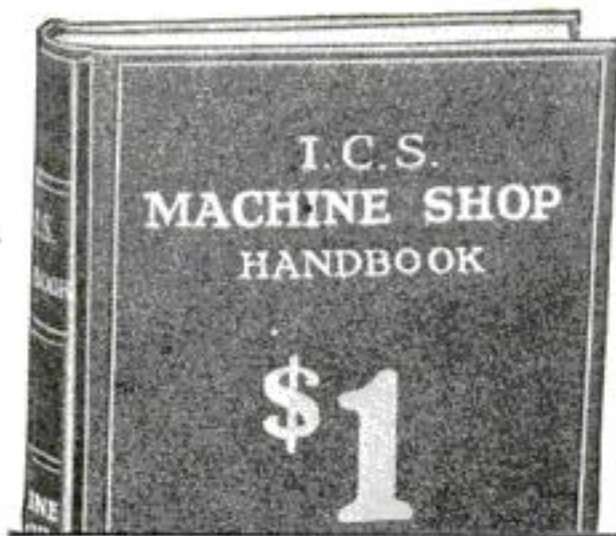
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### Contents

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## Better Shop Methods

### Lathe Shortcuts that Save a Machinist's Time

(Continued from page 131)

suggested in Fig. 4. Two spots, A and B, are turned on the piece. A corresponds to the diameter of the large end of taper and should be just the right distance from the shoulder to the end of taper. B represents the diameter at the small end. The angle of the taper is set parallel with the line of tool travel by moving the tailstock until both spots are exactly equal distances from the point of the tool. This distance may be tested with an inside caliper, as shown. If the measuring is done carefully, there will be no doubt about the accuracy of the taper and very little, if any, filing will be required.

Winding springs on a lathe is an awkward job for some mechanics. It does not need to be so if the method illustrated in Fig. 5 is followed. The wire is passed through a short piece of brass or copper tubing and the end is gripped under one chuck jaw. Insert a tool or short steel block in the toolpost between the screw and the tube and press the tube down flat, just tightly enough to allow the wire to pull through without breaking. Gear the lathe for the right pitch and proceed to wind the spring with the slow back gear speed.

THE mandrel in Fig. 6 will find many uses in any machine-shop. It is a time-saver for turning bushings, pulleys, gears, or any cylindrical shapes within its capacity. It is especially useful for a job where the hole is over size and will not fit a standard mandrel, as well as for turning a job having a cored hole that is not to be bored out. The movable cone should be a nice sliding fit and the nut should have a right-hand thread.

Figure 7 shows an effective way to drive a job on a mandrel when there is a heavy overhang that perhaps would cause the work to slip around on the mandrel, as is frequently the case when turning and facing castings with a small hole.

We seldom think of a lathe doing the work of a punch press, but Fig. 8 suggests how this is possible and practical when the shop is not equipped with a press. The punch and die are constructed along conventional lines and supported in position by the saddle or by cross pieces resting on the ways of the lathe. The punch holder is bolted to a top plate, which comes in contact with an eccentric shaft held on the centers and driven by a dog in the usual way. Each revolution of the spindle gives a stroke to the punch, and the speed is limited only by the ability of the operator to feed the material through the die. The punch and die are assembled as one unit. The fiber washer shown was a job produced by this method.

As there are more ways than one to skin the proverbial cat, so there are more ways than one to produce a spherical surface on a lathe. A novel and interesting method for doing this is indicated in Fig. 9. A piece of drill rod pointed at both ends does the trick. The over-all length is equal to the radius of the circle to be

(Continued on page 133)

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**Better Shop Methods****Lathe Shortcuts that Save a Machinist's Time**

(Continued from page 132)

turned. A center punch mark is made on the side of the cross compound and a similar mark is put on the tailstock in the center and in the same plane as the one on the compound.

The circle first is roughed out as closely as possible to a templet. The points of the rod are placed in the punch marks and the carriage held hard against the rod. By using a round nose or any suitable tool, the job then may be finished to a true circle. Engage the cross feed and hold the carriage against the rod while the tool is cutting.

Either concave or convex surfaces may be produced by this method. For a concave surface hold the rod against the tailstock. For convex surfaces put the rod on the opposite side and hold it against the headstock.

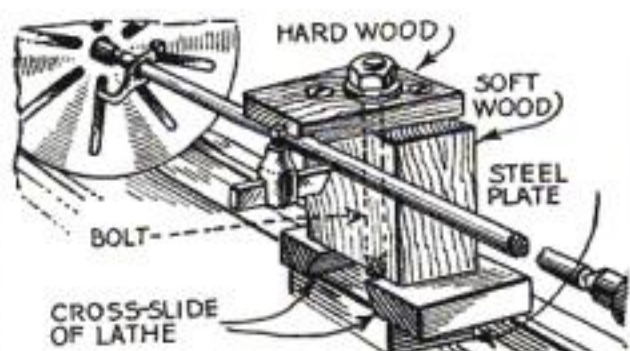
Have you ever tried to true up a commutator and bring the mica down smooth with the surface with a hacksaw blade or other means? A much better and quicker way is by planing it off with the lathe carriage. Grind a tool such as a cutting-off tool from 1/16 to 1/8 in. wide. Give the tool one-quarter turn in the holder, with the cutting edge toward the shoulder, and plane the mica in each groove down smooth by working the carriage back and forth by hand (Fig. 10).

Figure 11 illustrates the use of a box tool in the engine lathe. A tool of this type may be rigged up for many small manufacturing jobs, such as turning, facing, and cutting off small pins, small bushings and similar jobs. Many variations of this tool are possible and with different size guide bushings, many sizes of stock may be handled.

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THE follow-rest illustrated is an aid in turning shafts of small diameter, especially when other equipment is not available. This simple arrangement will do the work as well as a more expensive special follow-rest.

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A follow-rest made mainly of wood

which bears against the shaft, is of hard wood and is mounted on the block with wood screws. The follow-rest is bolted to the carriage with a machine bolt, which passes down into a plate under the ways of the cross slide. When necessary, the bearer can be adjusted for height with packing pieces.—CHARLES KUGLER.

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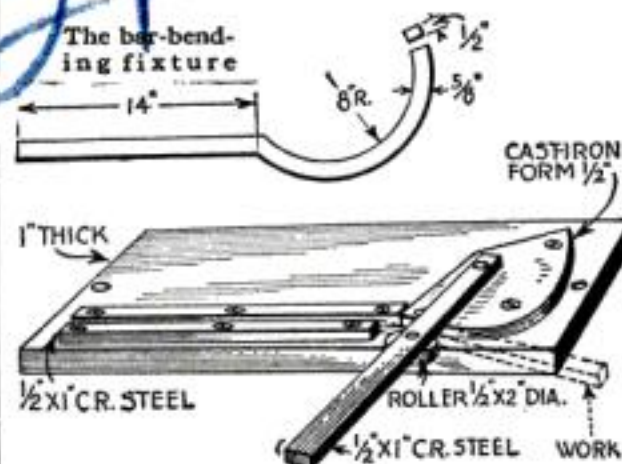
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## Better Shop Methods

### Simple Fixture Aids in Bending Bar Stock Quickly

**T**HE bending fixture shown below was made for shaping a few special parts as cheaply as possible. In the same way many similar jobs may be handled at a minimum expense.

A flat cast-iron plate is planed on one side only. The form is turned to the correct radius and fastened to this plate with three filler-head screws. Two strips of  $\frac{1}{2}$  by 1 in. cold-rolled steel are fastened to the plate adjacent to the form and with a



space between equal to the width of the stock that is to be bent—in this case  $\frac{1}{2}$  in.

The bending lever, which is a piece of  $\frac{1}{2}$  by 1 in. cold-rolled steel, swings on a stud passing through the center of the form. It is provided with a steel roll 2 in. in diameter, set to roll the work up close to the form. The lever stud has no nut on top, so that the lever can be removed for inserting and removing the work.

The work is heated at the point where the bend starts, and the sharp angular bend is made by holding it in the vise. The steel is put between the holding strips on the fixture, the bending lever is put on its stud, and the bend made.—H. L. W.

### Cutting Odd-Sized Core Boxes on a Circular Saw

**T**HE most difficult part of building a core box is in making the circular cut for the core. This often is done with a saw having a corresponding radius, but if the radius of the saw available differs from that of the cut to be made, the problem becomes more complicated, especially if there are no other tools at hand with which to do the work.



Sawing recess at an angle

the depth of the saw teeth. The saw is raised after each cut until the proper depth has been reached.

The angle to which the saw is set can be determined graphically, although from experience I have found the cut-and-try method quite satisfactory.—C. K.

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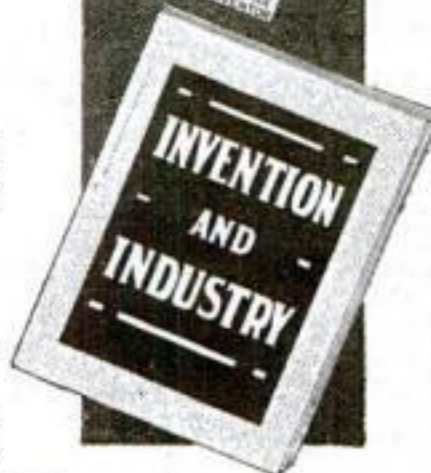
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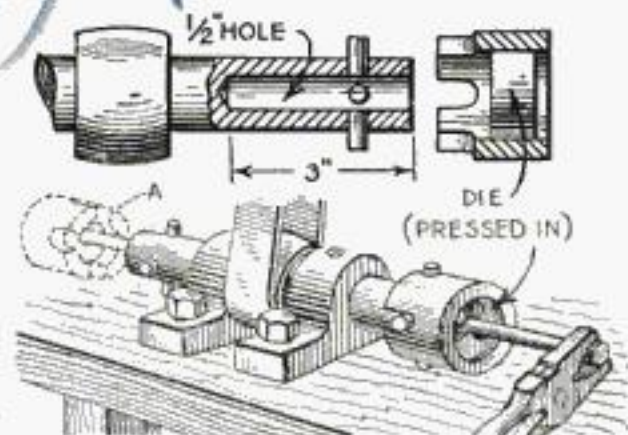
## Better Shop Methods

### Cheaply Made Bench Machine Threads Small Work Rapidly

A SIMPLE threading machine that saves time in cutting threads on small work is illustrated. With it many odd jobs of threading can be done more conveniently and quickly than by putting them in the lathe.

Two pillow-block bearings are bolted to the bench to take a shaft, which is fitted with a pulley and drilled at each end for four pins. These pins engage the four projections on a die-holder made of pipe. The speed should be about 250 revolutions a minute.

To thread bolts or rods, the bolt is gripped in a pair of pliers and the end



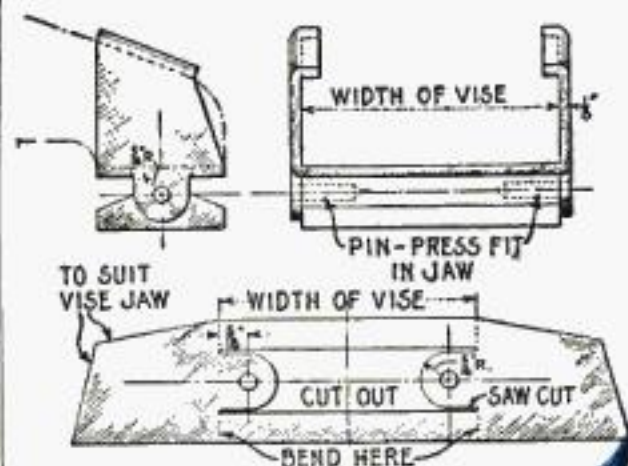
One end of the shaft runs the threading die on; the other turns it off

pressed into the die as shown. When the desired length has been threaded, the rod or bolt is drawn from the shaft, taking with it the die-holder. This, of course, stops the die-holder from rotating. The shaft never stops.

To run the die off the bolt, it is placed on the left-hand end of the shaft, as shown at A, the rod or bolt being held with the pliers as before.

With a little practice threads may be cut rapidly and accurately. The cost of the machine is small, in this case being only \$1.50 for material and a few hours' work.—H. E. B.

### Constructing Swivel Vise Jaws to Hold Tapered Work



THE swivel vise jaw shown in detail above is one that has proved satisfactory for general work. The construction is so simplified that the cost is insignificant compared to the time it saves and the many uses to which it can be put. This design may be modified to fit a vise of any size or style. The jaws are of steel and are made in pairs.—WALTER LYON, Milwaukee, Wis.

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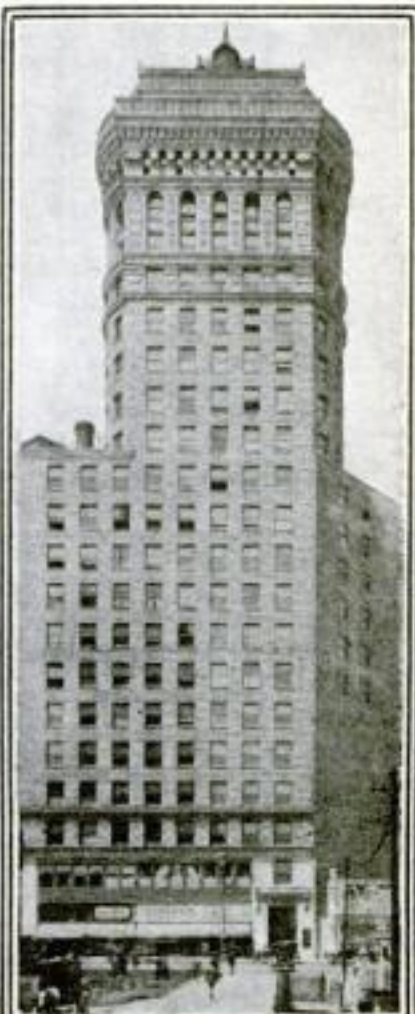
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## The Magic Stuff that Saved Nome

*(Continued from page 29)*

convert them into vaccines of the first order. These are used where a very quick immunizing response is needed. They shorten greatly the period required for preventive immunization.

Bacterins and serobacterins are made mostly from several strains of germs of each disease. When a person has pneumonia, for example, it may be one type of this infection out of several possible types; or it may have been caused by a number of mixed strains. The same thing might apply to cases of blood poisoning.

The infections are commonly mixed. Therefore it is vital, at times, that serums contain antibodies effective against a number of mixed strains.

THE bacteria used to produce these products come from typical cases in hospital and private practice all over America. The specimens are examined by bacteriologists for identification, and the various strains or types are selected and cultured.

One of the important developments of immunology was the discovery that susceptibility to various diseases—diphtheria among them—could be told by skin tests made by injecting preparations of disease germs between the layers of the skin. In this way the presence or absence of sufficient natural specific antibodies in the blood could be determined through slight inflammation or lack of it, at the point of inoculation.

Thus experiments were begun to learn why a few children never contracted diphtheria, although exposed. The reason was found in the antibodies in their blood. This led to the Schick test, by which the immune children could be picked out. It led also to the development of the toxin-antitoxin immunization, which makes susceptible children safe from diphtheria.

DIPHTHERIA, by the way, is peculiarly a disease of children. Very young infants usually are immune, it being believed that antitoxin from their mothers' blood passes into their bodies before birth. The highest degree of susceptibility lies between the ages of one and two, when only 30 per cent of children are immune. After the age of three the number of children contracting the disease falls off rapidly.

Why, though, should some children be immune and others not? The answer is that repeated exposures to disease, coupled with the strength to throw it off, gradually build up immunity. For this reason city children, constantly exposed to slight infections, are less a prey to diphtheria and similar infectious diseases than are country children. For this reason, young men from the crowded tenements during the war stood up against disease ravages where men from homes in sparsely settled sections went down easily. For this reason, too, an isolated community such as Nome is in particular danger from epidemics of diphtheria, and the danger is heightened

*(Continued on page 139)*



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## The Magic Stuff that Saved Nome

(Continued from page 138)

because medical supplies and medical skill are likely to be lacking.

The latest development with diphtheria antitoxin is in a super-concentrated form, the result of years of experiment to separate the antitoxin substance from the horse-blood serum in which it is produced. This was the sort of antitoxin that was carried into Nome—an explanation of the fact that 300,000 units could be compressed into a package, which, with its wrappings, weighed only 20 pounds.

The modern antitoxin not only is less bulky than the serum of former years, but is correspondingly more potent and more easily and quickly administered, without the suffering once forced on the patient.

AMONG outstanding recent developments is the fact that scarlet fever, perhaps the most troublesome of children's diseases, at last seems to have been brought to control and prevention by the discoveries of Drs. George and Gladys Henry Dick, of Chicago, and of former workers.

The Dicks produced experimental scarlet fever in human volunteers through the use of cultures of various strains isolated from scarlet fever cases. After producing this disease, they demonstrated that susceptibility to scarlet fever could be determined by skin inoculation, as in diphtheria.

It is believed, though not positively demonstrated, that scarlet fever is caused by certain specific strains of the streptococcus, the deadly bacterium that causes blood poison of different types.

Seventy-four per cent of the deaths from scarlet fever occur in children under 10, and survivors frequently develop later trouble due directly to this malady.

Again, as in diphtheria, it is probable that the natural immunity from scarlet fever, acquired by many, is a contact immunity, brought about by repeated exposures and mild infections. In a private school, with students from protected homes, 85 per cent were found susceptible to scarlet fever, while in a public school in New York City only 22 per cent were susceptible.

The means now are readily available not only for carrying out the Dick test, but for applying the immunizing treatment to those susceptible, and for administering the scarlet antitoxin to those manifesting symptoms.

THE germ of scarlet fever is thought to be only one strain of the streptococcus bacterium. Other strains of this organism are responsible for serious diseases, including blood poisoning, erysipelas, and childbirth fever. Science has found a way to produce a serum containing antibodies capable of antagonizing or neutralizing a wide variety of these strains, and recent advances have improved the activity or potency of this serum.

Experiments with antistreptococcus (blood poison) serum in smallpox cases

(Continued on page 140)

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## The Magic Stuff that Saved Nome

(Continued from page 139)

are reported to have shortened the course of the disease and prevented pitting and secondary infections. In erysipelas, streptococcus pneumonia, streptococcus complications in scarlet fever, and in other infections, this serum has brought marked advances in medicine.

This serum also has been experimented with in the treatment of pernicious anemia. One theory regarding this little understood disease attributes it to auto-intoxication of intestinal origin.

Auto-intoxication, or deterioration of the powers of the blood through the absorption of poisonous matter not properly eliminated, is one of the commonest of ailments that make life miserable and ultimately kill. Wrong diets or sedentary habits cause bacteria to infest the intestines, and the toxic substances that result give rise to ailments that are hard to fathom. Medical research in this direction has produced artificially the acidophilus bacillus, which in normal health flourishes in the intestinal tracts and destroys enemy bacteria.

**PNEUMONIA** is a peril that we all face. This disease, claiming one-tenth of all who die from infancy to old age, may never be conquered altogether, but extraordinary work has been done in its subjugation. Some years ago a pneumonia serum was produced from the blood of horses inoculated with pneumonia bacteria. This serum, though successful, contained protein matter from the horses' blood that caused harmful reactions in the patient. Also, lacking hospital facilities, the ordinary practitioner was unable to use it.

Recently, however, Dr. Frank W. Hinton succeeded in taking the antibodies out of the serum entirely and suspending them in a clear water solution. This pneumonia antibody has been used with considerable success and has sufficed to cut down somewhat the reactions that ordinarily followed use of the horse serum. There are mixed serobacterins, too, useful in preventing or treating common colds and bronchitis.

Next to pneumonia and tuberculosis, typhoid fever is the most deadly of diseases, attacking fully half a million persons in the United States every year, of whom every seventh person dies.

**YET** in the armies of the world typhoid has been wiped out by the discovery of immunization, and it would disappear from civilian life if inoculation were to be practised universally. The average duration of immunity is 30 months. Occasionally one injection of typho-bacterin prevents an attack of typhoid fever. The immunization is harmless to healthy persons, and confers almost absolute immunity.

I should mention, too, the development of a vaccine against hydrophobia, the marvelous work of the lockjaw antitoxin, which has eliminated this disease from the armies of the world as a cause of death, and the experiments with the control of whooping cough and meningitis.

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## Why the Eclipse Was Late

(Continued from page 39)

already it is beginning to change from the graceful, symmetrical form it holds at the maximum sunspot period to the shorter, brighter form that marks the minimum period.

"Also, photographs made with a camera of 17-inch focal length showed the corona to extend 2,000,000 miles into space. Our largest camera, the focal length of which was 62.5 feet, did not show this amazingly great extension of the corona rays for the reason that its lens was not fast enough to record the exceedingly rapid passage of light through this enormous distance.

"WITH the large camera, however, we obtained images of the moon  $7\frac{1}{4}$  inches in diameter, which is on a scale large enough to work out the details of the structure of the corona. This is the principal topic of inquiry at all eclipses, of course, for the corona—the fiery halo of the sun—is seen only at such times.

"Photographs made with cameras of various focal lengths will enable us to determine the laws of distribution of the materials making up the corona.

"We used also two interferometers to determine the distribution of the gases in the corona and also the motion of the gases, our chief hope being to determine whether the corona rotates with the sun in much the same way as our atmosphere rotates with the earth.

"We employed a small spectroscope to find out the relative brightness of the various gases in the corona, and two large spectroscopes in an endeavor to determine what is the distribution of the metallic vapors immediately above the sun.

"Investigations of this sort are of prime interest to the astronomer; of little interest, though, to the layman, to whom an eclipse simply is a splendid spectacle. The spectacular features of an eclipse escape the scientific observer almost entirely. That has been my experience, at any rate.

"AT THE recent eclipse, for example, the amount of spare time I had during the two minutes of totality was exactly 15 seconds. During the rest of the time I was exposing photographic plates, or making ready for the next exposure. Some day, though, I may get an opportunity really to see an eclipse.

"As in other expeditions, we set up a camera also to determine accurately the photographic diameter of the moon as a check on the Einstein theory. We know the distance of the moon from the earth, and we are able to compute its diameter. Photographs obtained with this instrument, which has a focal length of 15 feet, may enable us to ascertain whether the photographic diameter of the moon checks with its computed diameter. Many scientists believe it will not; that the photographic diameter is larger. If they are right, it will show that some force other than that assumed by the Einstein theory is the cause of the deflection of the light of the stars that are nearly on the same line as the sun.

"That the eclipse was late in arriving

(Continued on page 142)

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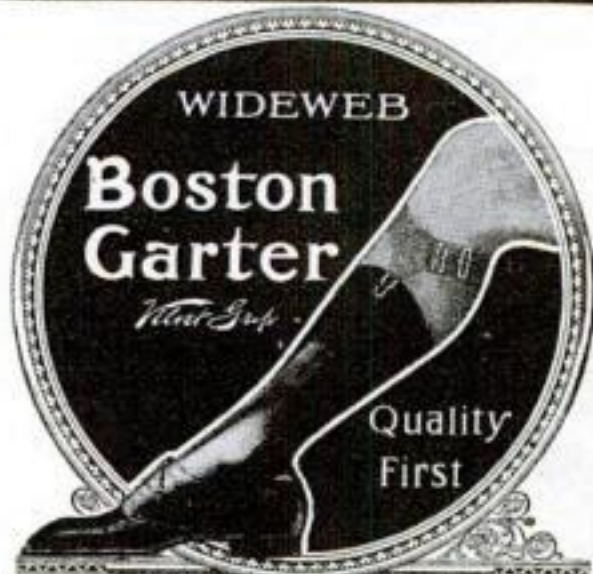
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## Why the Eclipse Was Late

(Continued from page 141)

at the various stations occasioned considerable comment. There is nothing extraordinary, however, in this. In the five eclipses that I have observed, some were late, others early. The reason for this is that we do not know the orbit of the moon with extreme accuracy, and therefore cannot compute with entire accuracy the width and length of the shadow.

"The size of the shadow depends on the relative distances between the sun, the moon, and the earth. The orbit of the moon is influenced not only by the gravitational attraction of the earth and the sun, but by several other planets, and just how much this deflects it in its orbit we cannot determine. If the shadow of the moon is slightly smaller than is computed, the eclipse will be late, as was the case with the recent one. If it is slightly larger, it will be early. An unavoidable error of only part of a mile will cause the eclipse to arrive either late or early. When we consider with what vast distances astronomical calculations are concerned, an error of part of a mile is not particularly great.

"THIS latest eclipse may bring us somewhat closer to solving the mystery of shadow bands—those amazing and elusive plays of light and shadow that many persons saw on the snow. We attempted to photograph them with a high-speed motion-picture camera in order to determine accurately their direction and velocity, but they eluded our camera. I understand, though, that moving pictures of the shadow bands were made successfully at the Wesleyan University observatory, Middletown, Conn.

"Since the eclipse several possible explanations of the shadow bands have been offered, some quite tenable, including the conventional explanation that they are due to heat motion in the air.

"Some substantiation for this theory seems to be offered by the fact that, while the shadow bands were clearly observed on the ground, they were not seen on the wings of airplanes. The speed with which the airplanes were moving, though, rather than the low temperatures in which they moved, may have been the cause of this.

"WITH the radio tests our expedition was not actively concerned. The results of these tests, so far as I have been able to learn, seemed more or less inconclusive. In some places radio reception was reported to have improved during the darkness of totality; in other places listeners reported no difference.

"Photographs of the eclipse made from the air were for the most part of scant value to science for the reason that the rapid motion of the planes caused distortion in the pictures. Perfect definition would have necessitated that the plane be at rest, absolutely immovable, at the time each photograph was taken. Possibly a method of bringing this condition about may be developed in the future. Also, improved photographic apparatus some day may make it possible to photograph the moon's shadow from the air and thus fix its path with absolute accuracy."



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## The Taming of Dynamite

(Continued from page 34)

high explosives, but the explosives manufacturer has been driven to look for cheaper materials as well adapted as natural sugars to his requirements. He has asked the research chemist to prepare specialized types of sugars—sugars not sweet to the taste, but that lend themselves to the production of explosive compounds.

"In fact, the chemist has gone back to the elements of nature—air and water—as the starting point of many new compounds. This meticulously careful investigation has brought about the cheapness of modern high explosives. The traveler on the railroad today rides for a lower rate, and the motorist pays lower taxes for building his good roads, because the tunneling, ballasting, grading, and excavating are carried out at a fraction of the cost otherwise necessary."

AT PRESENT the great bulk of our nitrates indispensable for explosives and many other uses, comes from South America. But the United States would never again be caught with a shortage, for the fixation of nitrogen from the air is now a chemical and commercial fact.

There are various methods of extracting nitrogen from the air, where there is an inexhaustible supply. One way is to pass an electric spark of titanic proportions—a veritable thunderbolt—through the air in a chimney, breaking up the atoms and ultimately getting nitrogen as a weak acid.

"Smokeless powder," Doctor Stine continued, "is a hard, hornlike material produced by the physical mixing of nitroglycerine and nitrated cotton. The proportion is so selected and the dimensions of the powder grain are such that it will burn completely, converted entirely to gaseous products free from particles of suspended carbon and ash. The burning of this combination is therefore smokeless."

"The manufacture of smokeless powder involves adequate supplies of glycerine, nitric acid, and some form of cellulose. The research laboratory now has produced nitrated cellulose not only from cotton, but from wood pulp and other natural sources. It is not impossible that cellulose will eventually be a product of the research laboratory."

"OUT of cellulose," he went on, "come artificial silk, ivory substitutes that now seem indispensable, leather substitutes, a near-glass that is used largely in automobiles, and various other products that people use every day. Out of the research laboratory has grown a multiplied industry. Even dyes and paints have a chemical relationship to explosives."

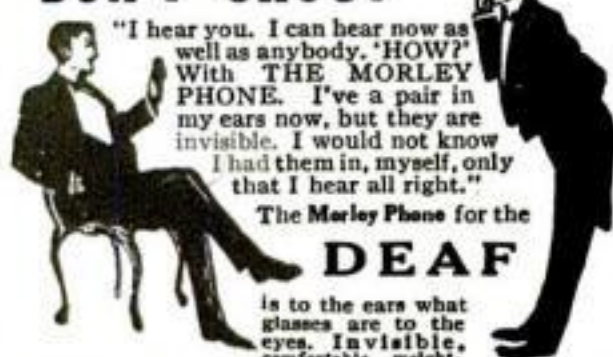
Doctor Stine concedes the probability of producing artificially the particular fibrous matter that, as part of wood, is used to make some explosives. Going still further, we may conclude that some day artificial cotton and woolen fabrics may be evolved.

Along this line we might indulge in fantasies. The chemical research workers seem to be on the borderline of a new world of invention.



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## Here Are Correct Answers to Questions on Page 71

1. A little over 27,000 gallons of water for each acre of land. One inch of rain in New York City means that about five and a half billion gallons of water fall on the land covered by the city.

2. Deafness sometimes is due not to any trouble with the nerves of hearing or with the little water-filled sac in which these nerves end, but merely to some ear obstruction that prevents the sound vibrations from reaching this sac. In cases of this kind sound vibrations that enter the teeth may be conducted to the ear-sac through the bones of the head and may be heard in this way.

3. Nowadays the commonest materials for phonograph records are those belonging to a class of manufactured substances sometimes called "artificial resins." The artificial resins are made by chemical processes, mainly out of products of the distillation of coal.

4. A little air dissolves in water, just as salt or sugar does. When a glass of water stands around for a while, some of this air comes out of solution and makes the little bubbles.

5. A few fishes eat seaweeds or other fishes, but most fishes live on the microscopic plants and animals, millions of which are contained in every cubic inch of the surface water of the sea.

6. The full moon is *always* visible in the daytime when it is above the horizon and not hidden by clouds. Daylight simply makes it less noticeable.

7. They really evaporate just as water does out of an open pan. The chemical from which moth balls are made is one of the substances that can evaporate directly from the solid state without having to pass through a liquid one.

8. Yes, any electric motor can interfere with radio in its neighborhood if the motor is improperly adjusted, so that sparks are produced at its commutator. This causes a clicking in near-by radio sets as the motor turns. It usually can be stopped by overhauling the motor.

9. Probably, but not for a very long time. There is no friction in empty space, as there would be if the earth were revolving in air. The only known thing that is tending to stop the earth is the friction of the tides in the ocean. Probably this really does slow up the earth a very little, but the slowing is so small that science so far has not been able to detect it.

10. Because of the powerful magnets in the dynamo. The little hair-spring of your watch is made of steel. Under the influence of the magnets this spring sometimes gets magnetized. After that it attracts the other steel parts of the watch and will not work properly.

11. It is the unit in which scientists measure the strength of light. Originally it was the strength of the light given out by a standard candle made of a certain kind of wax and of a certain fixed size. A light one candlepower strong is just about visible a mile away on a clear, dark night.

12. Yawning is a stretching and relief of the muscles of the chest and of the breathing apparatus, usually after these muscles have been tense for some time.



## Do Your Eyes Lie?

(Continued from page 38)

sible to change the ugly thing and make it seem quite beautiful.

To go back to the house proposition, for instance. You have seen how easy it is to transform an exterior. Suppose we discuss a few things we might do with the interior of a house.

If the builder has placed your mantelpiece too high, you don't have to sit and bewail your fate at having all your rooms look ill-proportioned. You simply place two long, tall vases on the floor, at each end of your mantelpiece. Your imagination draws the connecting lines that seem to draw down the mantelpiece. Or you might place two low, fat vases on the ends of the mantelpiece itself, and one of those broad, fat clocks in the middle.

**I**F YOUR whole room is too high, try placing objects with vivid colors, such as bowls of bright flowers, on the tables; not on the mantelpiece. By such methods you can direct the eyes where you will; you can keep them down if you like.

Or perhaps your room is too low. Then you would run parallel stripes, rather pale in color, from the floor to the ceiling, or you would place a long mirror high on the wall, to reflect the ceiling, and so make your room look lofty. Mirrors always give a feeling of space.

Nowhere is the principle of color harmony—and, for that matter, the principle of line—more important than in dress. I can give you one very simple instance that illustrates them both. Just recently we have discovered that a row of white glass buttons straight down a black dress, from the throat to the hem, can give a look of slenderness. You can suggest a line just by three or four buttons. Or, you will be astonished to find how slim you can make yourself look by wearing dresses cut with the lines sloping inward a little toward the top. That adds an inch or so to your height, too.

Then there are the "distinctive," as the advertisers would say, sleeves and cuffs. If you have short fingers, you'll be surprised to discover how much longer they look when you wear a cuff that droops over the hand. And you'll be equally surprised to discover how much shorter they look than they really are if you wear a number of rings or if you wear a bracelet close to your hand.

**T**HEN there are shoes. If you have normal sized feet, you never have to worry about them. If you haven't, there are all sorts of things that will help you make them look normal. A short vamp, for instance, makes the foot look shorter. With a long vamp, the reverse is true. Laced shoes make the ankle look smaller, just as button shoes make the instep look higher. The black patches on the fancy white sport shoes that run back from the toe along each side, make the whole shoe look smaller by luring the eye away from the true outline.

If you can take an ugly outline and superimpose a beautiful outline, you deceive the eye into seeing only the beauty and being oblivious of the ugly. And that is the esthetic value of optics.

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### Your Colds

(Continued from page 41)

the membranes of the nose and throat too dry, which is harmful. Warm, dry air makes us very susceptible to colds. The humidity never should be allowed to drop below 40 per cent and should be above 50 per cent for the most healthful conditions. How you may determine the humidity of a room by means of a hygrometer, or dry-and-wet-bulb thermometer, is shown in the chart on page 41.

If the relative humidity is below 50 per cent, water should be evaporated in the room. If the home is heated with a hot-air furnace, there is a place provided in the furnace for water. This should be kept full. If it does not supply enough moisture, pans of water may be placed on or below the registers. If the home is heated with steam or hot water, pans of water may be placed on the radiators, or containers for water may be placed behind the radiators.

TO THE factor of humidity as a cause for greater susceptibility to colds in congested centers must be added the ease of travel for germs that thrive in the heart of a crowded city. Every streetcar and subway train, every place of assembly, is a favorite stamping ground for the germs of disease. Moving-picture theaters and other indoor amusement establishments enable them to thrive, multiply, and spread their baleful influence. In the country, on the other hand, these agencies of distribution are lacking, and so the rural population is relatively less susceptible to colds.

For similar reasons, indoor workers are likely to suffer more than those whose occupations keep them in the open air. The exception to this rule is found in the case of the outdoor worker who is subjected to severe exposure. The weakening effects of exposure render him especially susceptible to the graver menace of pneumonia. Another factor of importance is the question of home conditions of the outdoor worker. If he spends his nights in close, ill-ventilated, and congested surroundings, the comparative immunity from minor disorders will be nullified.

In the prevention of colds medical authorities say that there are two important factors:

FIRST, the common cold, at least some varieties, is extremely contagious. Prevention lies in avoiding contact with sufferers; for the colds may be transmitted through the common drinking-cups, roller towels, door-knobs, hand-shaking, sneezing, or coughing.

Second, colds are most apt to attack overfed, under-exercised and constipated people, and those who avoid fresh air. To avoid colds, therefore, keep fit; avoid overeating, eat fruit and fresh vegetables and not too much meat or pastry; get outdoor exercise daily. To keep the tone of the body high, and therefore less susceptible to colds, avoid too heavy, soggy flannel underwear or, on the other hand, underwear of weight so light that it allows a chilling of the skin at every

(Continued on page 147)



## Your Colds

(Continued from page 146)

wintry zephyr. Individuals differ in their requirements in this respect, and it is not wise to lay down any rule.

A quick cold-water sponge, especially of the throat and chest, upon rising in the morning, followed by a brisk rub, will stimulate the circulation in the skin and train it to a quick response. Wet feet, lack of sleep, and over-fatigue bring on many a cold, and should be avoided.

The treatment of the common cold after it appears, never is very satisfactory. However, if the cold is detected at a very early stage, you may avoid some misery by a hot full-tub bath, followed immediately by rest in bed in a fairly well ventilated room for 24 hours or more (preferably three days), light diet, and a brisk purge such as may be accomplished by a dose of magnesium sulphate.

These measures may be helpful in shortening the course of the malady and in preventing involvement of the ear and the cavities of the head, which not infrequently occurs, and remember that a cold is not a simple matter. Neglected, it may lead the way to a really serious disease. The services of the family physician should always be sought in severe attacks of this much neglected malady.

## How Quickly Can You Stop Your Car?

(Continued from page 81)

cases each driver had his foot on the accelerator and was forced to shift position. The smallest elapsed time in these instances was 35/100 second. With most of the subjects the time lost was from four- to six-tenths of a second. With hand brakes the average was even higher.

Applied to various rates of speed, the bureau measurements show astonishing results as to the distances traveled in the half-second interval of mental reaction established as the average. At a speed of 15 miles an hour the progress of the car during this interval is 11 feet; at 20 miles, 13 feet; at 25 miles, 18 feet; at 30 miles, 22 feet, and at 40 miles about 28 feet.

The workings of a driver's mind are influenced by many factors. He may have the habit of considering problems disconnected with the immediate job of piloting his car, and may become so deeply absorbed that emergencies do not register quickly on his mind. Some psychologists believe drivers may be hypnotized by such factors as glaring headlights. These observers maintain that the brilliant beams induce hypnotic sleep in the driver who is tensed with watching the road ahead; also that many motorists lose mental control in the sharp glare of concentrated lights from an approaching car.

But whatever may be the cause of mental slack in any individual case, Uncle Sam's scientists believe their measurements will be of practical value in awakening drivers to greater alertness and caution, and in setting new standards of driving efficiency. Further, they believe that present brake-testing methods may be revolutionized by apparatus that more closely duplicates emergency conditions.

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Operates from  
light socket.

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**DURAY**  
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## To Select a Loudspeaker

(Continued from page 78)

usually is made in such a way that the motion of the armature is magnified at the diaphragm.

All diaphragms have a natural vibration period of their own, and this has to be taken into account in the design of the loudspeaker. Otherwise there will be a tendency to greatly emphasize the tones in human speech or the musical selection that most nearly corresponds to the vibration period of the diaphragm.

The size and shape of the horn has a lot to do with perfect reproduction and there are a thousand and one other difficulties to keep the manufacturer of loudspeakers awake nights figuring out ways to overcome them.

A GREAT many radio fans build their own loudspeakers out of old phonograph horns, or homemade horns, and a single head phone or loudspeaker unit. Often these outfits give excellent results, especially when they are not forced to reproduce loud signals. The homemade loudspeaker that combines great volume with fine tonal qualities is rare indeed, and if you must have both volume and quality, it is best to buy the factory-built loudspeaker.

The most progressive radio dealers today are fitting up soundproof booths in their stores where they demonstrate receivers and loudspeakers. Always be sure to have the dealer show you what the loudspeaker will do on both loud and weak signals and with various stages of amplification. Even if your ear is not musically trained, you can tell when voices sound natural and lifelike. In listening to orchestral selections, see if you can distinguish between the various instruments.

If the voices sound high and tinny, it is because the loudspeaker is failing to reproduce the low notes. Deep, hard-to-understand voices indicate the loss of the high notes and overtones that make human speech clear to the human ear.

Since head phones give such excellent quality, it is worth while to ask the dealer to allow you to listen on a pair of them plugged into the detector stage of the receiver. By listening with a pair of head phones and the loudspeaker alternately, you will be able to judge the quality of the loudspeaker.

IT IS not fair to condemn a loudspeaker offhand because one or two selections do not reproduce clearly. The broadcasting station itself may be to blame, for some of them occasionally send out radio waves that are far from perfect reproductions of the sounds produced in the studio. In justice to the dealer who has no control over the time schedules of the various stations, you should arrange your visit to his store at a time when you know that one of the better local stations is to be on the air with a good program.

IF YOU are a beginner in radio, you won't want to miss an article next month telling how to build a single-tube receiving set of unusually simple construction, yet of high efficiency.



## How to Build a Radio-Frequency Amplifier

(Continued from page 75)

degrees with the panel *L*. A slight error in setting the angle of the coils will not make much difference, however, since the additional feed-back when the coils couple together can be compensated for easily by a small change in the setting of potentiometer *I*. The sockets *J* and *K* should be placed with the filament binding posts away from the panel *L*.

The filament circuit should be wired first. Connect one terminal on each rheostat and run a branch from this wire to the negative-A-battery binding post 3. Now connect the other terminal of rheostat *G* with the right-hand filament binding post of socket *J* (as seen from the rear). Next, connect the remaining terminal of rheostat *H* to the left-hand filament terminal of socket *K* (as seen from the rear).

The two remaining filament binding posts on sockets *J* and *K* now can be connected and a branch run from this wire to the positive A-battery binding post 4. This completes the filament wiring.

THE outside terminals of potentiometer *I* should be connected as shown in Figs. 1 and 3. One terminal goes to the wire between the rheostats and the other over to the wire from binding post 4.

Run a wire from the end of coil *B* nearest the panel over to the end of coil *D* that also is nearest the panel. A branch from this wire should be connected with the center terminal of potentiometer *I*. Connect the plate terminal of socket *J* with one terminal of coil *C* and connect the other terminal of this same coil with the plus-B binding post 5. Now connect a wire between the rotary-plate terminals of variable condensers *E* and *F*, as shown in Fig. 1, and from this wire run a branch to the wire going to the center terminal of potentiometer *I*.

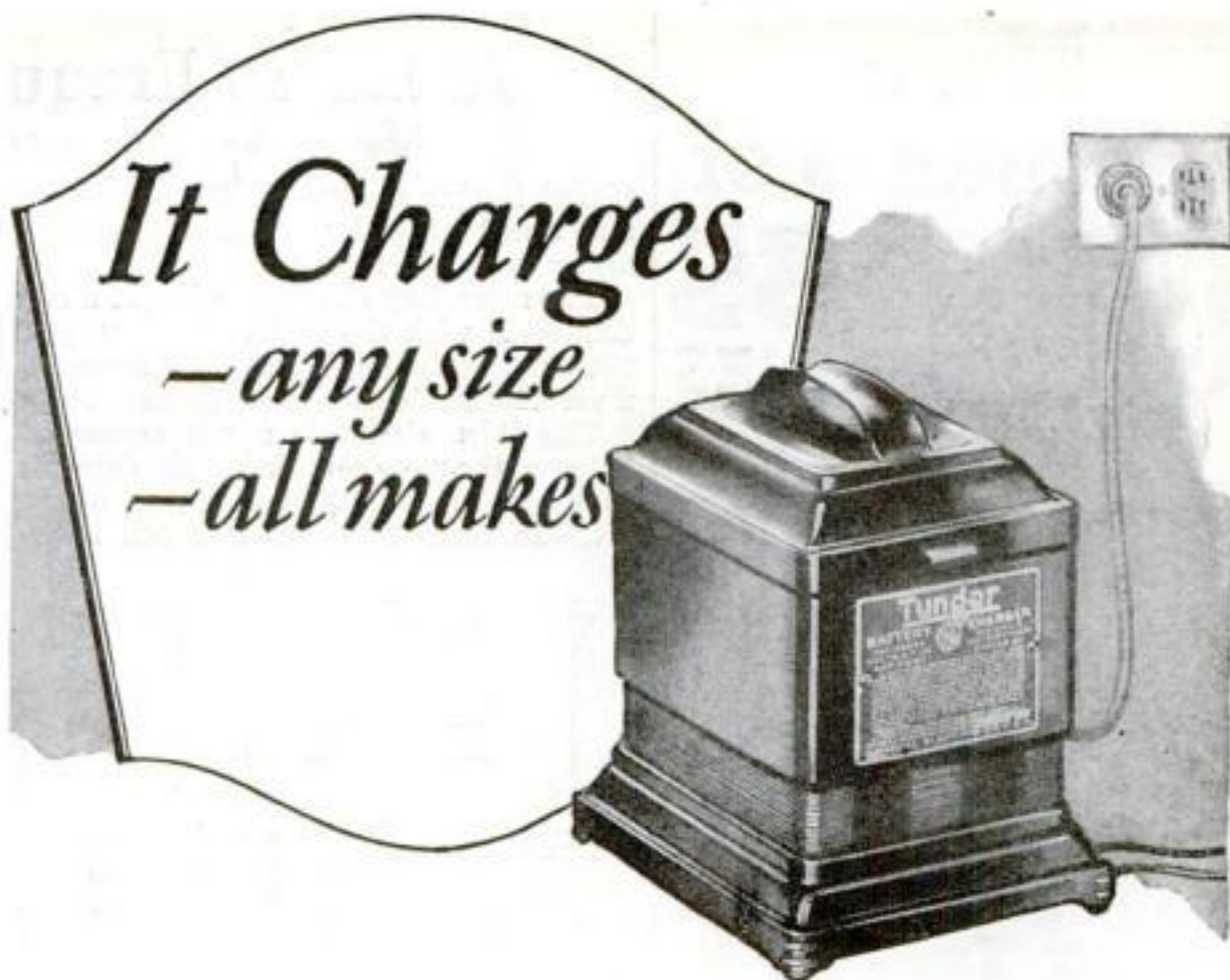
Next, connect the stationary-plate terminal of condenser *E* with the grid terminal of socket *J* and from this wire run a branch to the remaining terminal of coil *B*. These connections are shown clearly in Fig. 6. Now connect the stationary-plate terminal of condenser *F*, the grid terminal of socket *K* and the remaining end of coil *D* in the same fashion.

AFTER this, connect the plate terminal of socket *K* with binding post 6 and connect the two ends of coil *A* with binding posts 1 and 2, as shown in Figs. 1 and 2. This completes the wiring of the radio-frequency-amplifier unit. The order in which the connections have been described results in making all the hard-to-get-at connections first.

The final step is to connect the radio-frequency amplifier with your receiver.

All ordinary regenerative receivers, regardless of the types of instruments used in them, operate on the same general principle. First there is a coil connected with the antenna and ground. This is called the "primary circuit" and may consist of a few turns of wire placed close to the secondary coil, or of many turns

(Continued on page 150)



The new Tungar will keep your storage batteries up—fully charged all the time. It charges radio "A" batteries of 2, 4, or 6 volts. Radio "B" batteries of 24 to 96 volts. And auto batteries, too.

It makes no disturbing noise—is simple—charges while you sleep. Just clip the Tungar to the battery, plug it in on the house current and leave it overnight to charge. A Tungar at home means clearer tone—full volume—your set at its very best all the time for all that's on the air.



The Tungar is a G-E product, developed in the great Research Laboratories of General Electric.

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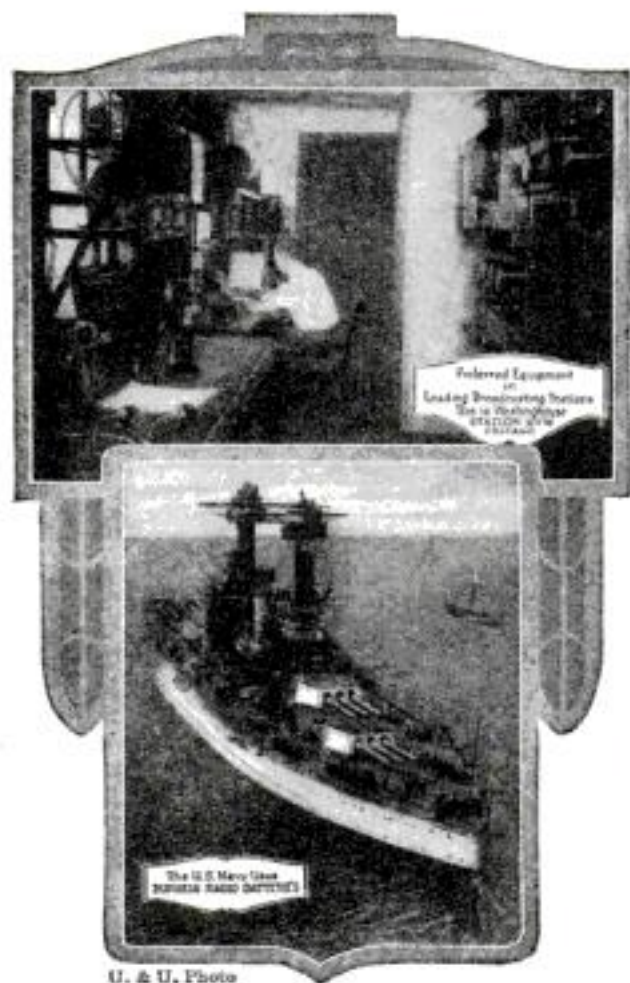
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## A Radio-Frequency Amplifier

(Continued from page 149)

placed farther away from the secondary and tuned either by means of taps or a separate variable condenser.

The secondary circuit consists of a coil connected with the grid and filament of the detector tube and tuned by means of a variable condenser or a variometer.

The third circuit is a coil connected between the plate terminal of the detector tube and the plus-B binding post of the set. In some receivers this coil is ar-

have a choke that will kill the signal strength.

Coil X should consist of about four turns of wire. Any size will do—bell wire is particularly recommended because the insulation is heavy enough to allow the wire to be wound on the tuning coil without fear of short circuits.

One end of coil X is connected with the binding post that was formerly used for connecting the antenna, and this binding

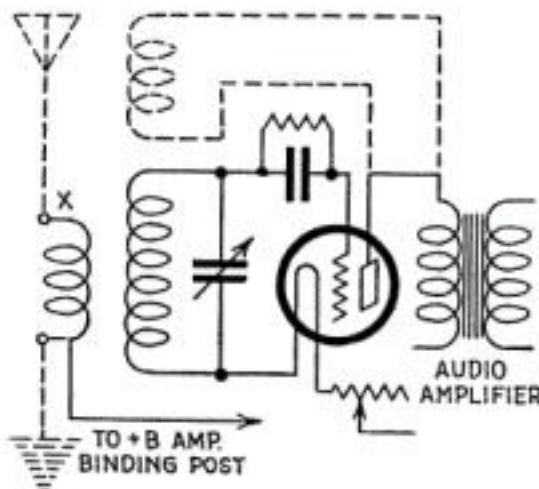


Fig. 8—How to hook the radio-frequency amplifier to a regenerative receiver using aperiodic primary. Four turns of the primary can be used as coil X. The antenna binding post should be connected with binding post 6 of the radio-frequency amplifier instead of antenna

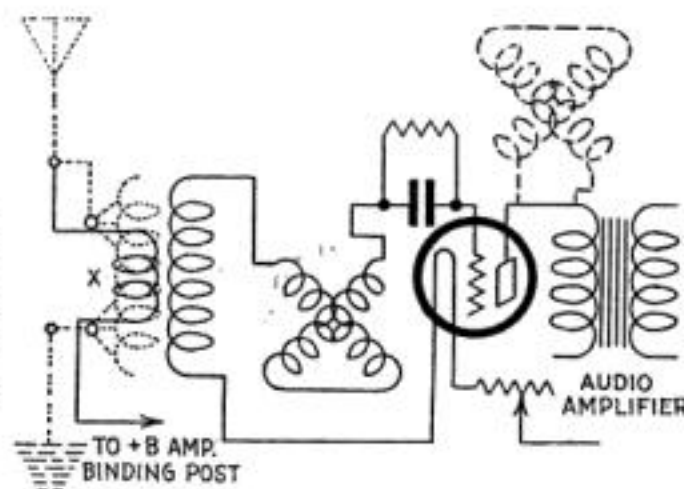


Fig. 9—How to hook the amplifier to a regenerative receiver using variocoupler and two variometers. If your variocoupler has enough taps so that you can get down to four turns in the primary, connect as in Fig. 8; otherwise wind coil X on top of the old primary winding, which should be disconnected entirely from the new circuit

anged so that it can be rotated close to the secondary coil. This is known as tickler feed-back. In other sets a variometer is used to obtain feed-back by tuning the plate circuit.

So-called single-circuit sets are those in which the secondary coil is also used as the primary.

In order to hook up this radio-frequency-amplifier unit to your present receiver, you must first convert your set into a simple detector circuit and then place coil X, shown above dotted lines in Fig. 2, close to the secondary circuit of your receiver. How to do this is shown in Figs. 7, 8, and 9. The foregoing discussion of the principles on which the regenerative receiver operates is included only so that you may be able to figure out how to make the hook-up if your receiver is outwardly somewhat different from the ordinary types.

IT IS assumed that your receiver already includes one or two stages of audio-frequency amplification, for most radio fans will not be interested in adding radio-frequency amplification unless they already have a stage or two of audio amplification to bring the signals they receive up to loudspeaker strength.

Figure 7 shows the changes to be made in a so-called single-circuit receiver in order to add the radio-frequency amplifier. The coil X of Fig. 2 is here shown wound around the detector tuning coil after the antenna and ground have been removed and the tickler coil (the rotating coil) has been removed from the circuit. Be sure to take the tickler coil completely out of the circuit, for if you simply connect a wire across its terminals, you will

post then should be connected with binding post No. 6 in the radio-frequency-amplifier unit. The other end of coil X should be connected with the plus-B amplifier binding post in your set.

FIGURE 8 shows how to combine the radio-frequency amplifier with an aperiodic regenerative tuner such, for instance, as was shown in the four-tube receiver described in the February issue. Here, the primary coil of the tuner will do very well as coil X, although it will be well to cut out all but four turns. The other changes consist in connecting the antenna binding post with binding post 6 of the radio-frequency amplifier instead of with the antenna, and then removing the other end of the coil from the ground binding post to the plus-B amplifier binding post in your receiver. Also cut the tickler coil out of the circuit.

Figure 9 indicates the method of connecting the radio-frequency amplifier with a regenerative receiver made up of a variocoupler and two variometers. First disconnect the stationary coil of the variocoupler as shown in Fig. 9, and wind five turns of bell wire on top of the old winding and connect as shown. Then cut the plate variometer out of the circuit entirely.

After the tubes have been placed in the radio-frequency-amplifier unit and the rheostats G and H turned on so that the tubes are burning about as brightly as in the audio stages of your set, all the tuning can be done with the two dials on the radio-frequency-amplifier unit and the one dial of your present set. If you find that the signals are broken up by howls and squeals at just the point where they come in strongest, turn potentiometer I slowly.



**This One**



**Y7K0-RN7-G6S2**



## Alternating Light Current as B-Battery Substitute

(Continued from page 76)

can be made of drinking glasses with the plates hung over the sides. This is a poor method, however, as the water evaporates rapidly and a crust will form all over the tops of the glasses.

The level of the borax solution in the jars or glasses should be adjusted so that the aluminum plates will have not more than one square inch exposed to the solution.

After you have constructed the rectifier, connect it with the current supply, as shown in Fig. 2, with a 50- to 100-watt lamp in the socket. Be sure to connect the lead and aluminum plates exactly as shown. If everything is right, the lamp will light almost to full brilliancy and then gradually become dimmer and finally go out altogether.

If the lamp does not go out, it is a sign that something is wrong. If you are sure that there are no short circuits in the construction of the caps, try reducing the level of the solution in the jars. If this has no appreciable effect, the chances are that the aluminum is not sufficiently pure for rectifier use.

After the rectifier is working properly as indicated by the lamp's going out, refer to the table at the bottom of page 76 and note the capacity values of the condensers to be used at  $C_1$ ,  $C_2$ , and  $C_3$ , according to the number of tubes in your radio set.

The primary circuit of an alternating-current bell-ringing transformer can be used for the inductance  $L$ . Such transformers are obtainable in any electrical supply store at a cost of not more than two dollars. Most of the larger stores carry telephone condensers of one- or two-microfarad capacity, suitable for use in this circuit. A variable resistance of the graphite disk type will do very well at  $R$ .

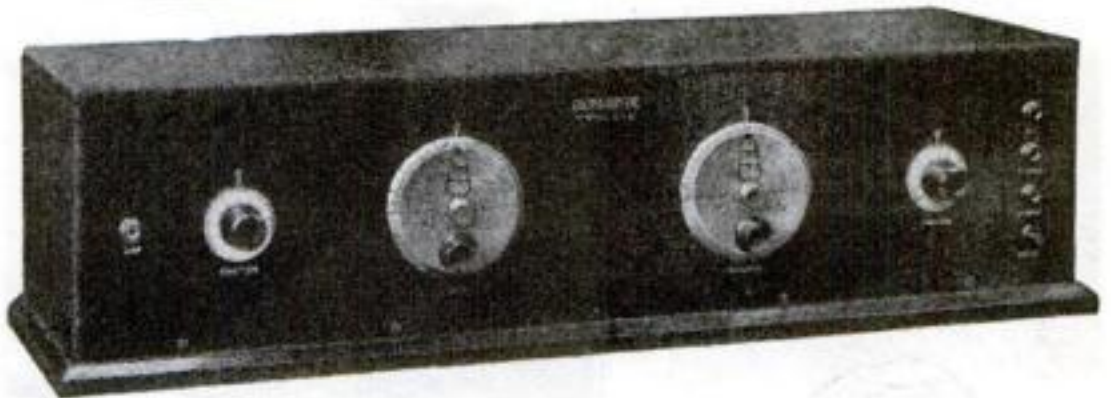
Practically all of the receiving sets made today have the secondary and filament circuits grounded, and since the minus-B-battery terminal is always connected with the filament circuit inside the radio receiver, it will be necessary to place a condenser in series with the ground lead of the receiver. Otherwise the electric-light current will be grounded and the fuses will blow. The value of this insulating condenser is unimportant so long as it is above .002 microfarad. The half-microfarad by-pass condensers are satisfactory for use at this point in the circuit.

The simplest arrangement of the B-battery eliminator is to place the rectifier jars in any convenient corner and mount the parts of the filter circuit on a piece of board fastened to the wall just above the rectifier jars. Do not inclose the jars, for they have a tendency to heat up after several hours of operation, and if they are closed in the temperature of the solution will rise to a point where the jars no longer will act as rectifiers. For this reason it is well also to place a double-pole, single-throw switch in the supply line so that the rectifier can be cut off from the house current when the radio set is not in use. If the vent hole is small, the rectifier should give from six to eight months' service without attention.



# Sensitivity

With the extreme acuteness of the bloodhound's scent, the Model L-2 Ultradyne detects the faintest broadcast signals—signals that are "dead" to other receivers—regenerates and makes them audible on the loud speaker.



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The Ultradyne book explains the "Modulation System" of radio reception and a special adaption of regeneration, as used exclusively in the Model L-2 Ultradyne. This is the latest development of R. E. Lacault, Chief Engineer of this Company and formerly Radio Research Engineer with the French Signal Corps Research Laboratories.

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The brass stator plates are soldered to notched spacer bars that maintain perfect alignment.



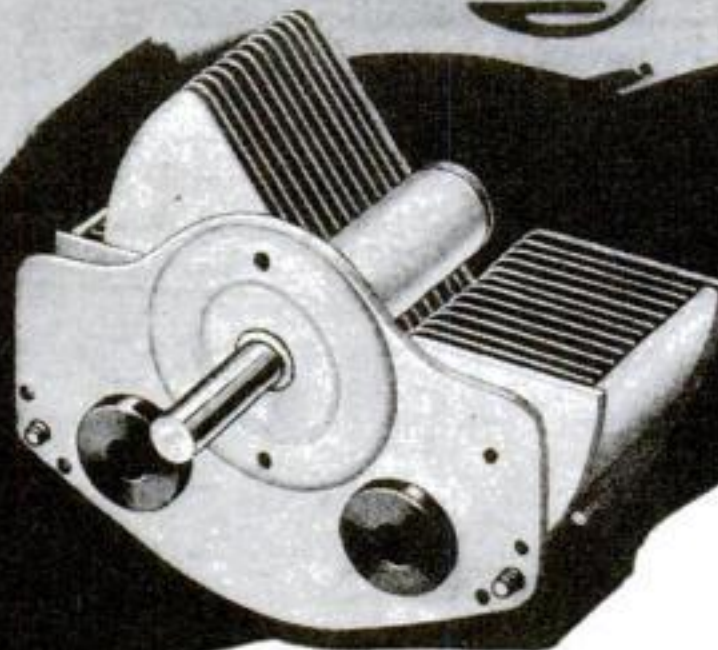
Plates, spacer bars and end plates are all soldered into a solid unit.



The bearing stud, attached to the stator mounting plate, supports the rotor. See illustration at bottom of this page.



Rotor revolves on a double bearing that is independent of the dial shaft.



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**N**EW and distinctive features are embodied in the design of the Bradleydenser. For instance, the rotor revolves on a long double bearing that preserves rigid alignment and yet eliminates the extra outer end-plate. This reduces the amount of di-electric material and increases the efficiency.

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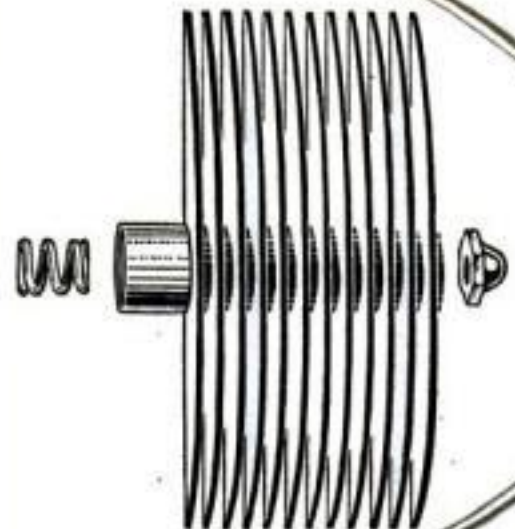
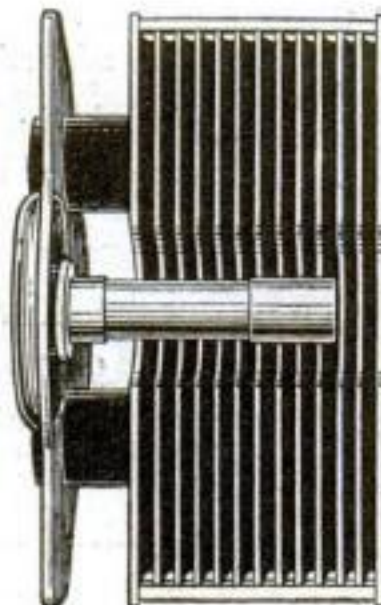
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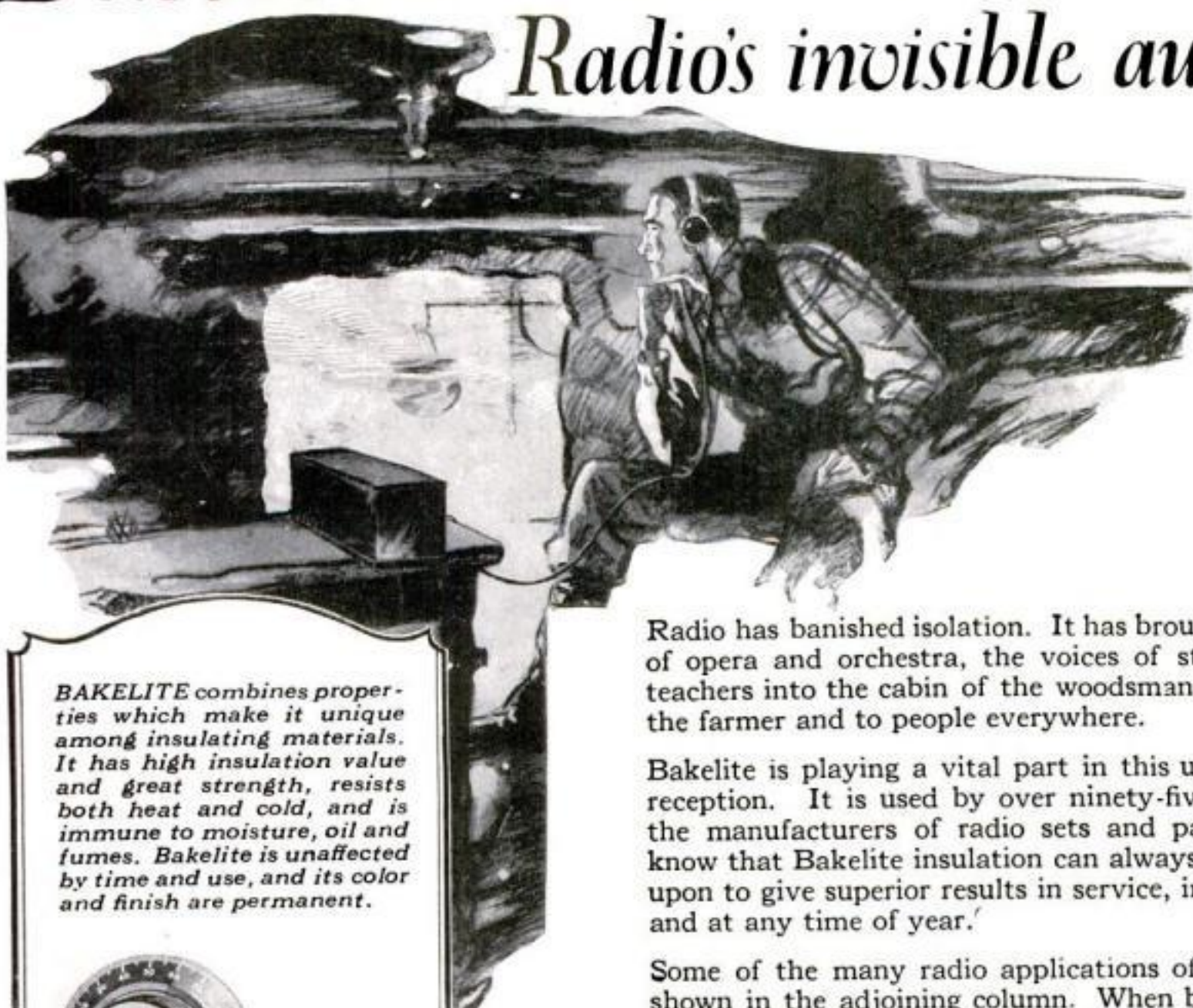


Disassembled view of the Bradleydenser showing bearing construction, rotor assembly and detachable dial shaft. The shaft does not carry the weight of the rotor.





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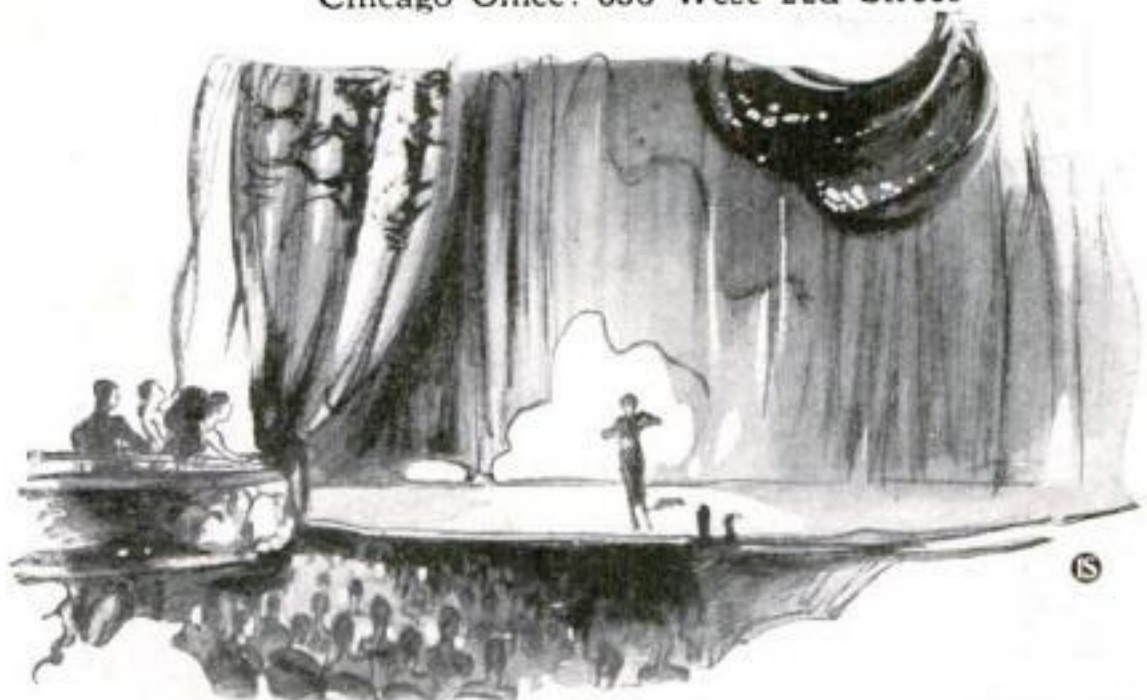
Some of the many radio applications of Bakelite are shown in the adjoining column. When buying a radio set or part make sure it is Bakelite insulated, for this is a definite indication of quality.

Write for Booklet 25

## BAKELITE CORPORATION

247 Park Avenue, New York, N. Y.

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Bakelite is an exclusive trade mark and can be used only on products made from materials manufactured by the Bakelite Corporation. It is the only material which may bear this famous mark of excellence.

# BAKELITE

TRADE MARK REG. U. S. PAT. OFF.



BAKELITE is the registered trade mark for the phenol resin product manufactured under patents owned by the Bakelite Corporation

## THE MATERIAL OF A THOUSAND USES



Shave every day—be comfortable

# COLGATE'S

## for better shaving



What a difference a few years make in fashions! How absurd some of them seem to be, when we look backward!

Would we be willing to adopt the grotesque styles to which our grandfathers submitted? It would take a constitutional amendment, at least, to drive us to such things.

If the compelling purpose back of whiskers that reached from ear to ear, and skirts that left no room for doubt was to eliminate difficulty in telling the sexes apart, its effectiveness can hardly be questioned.

Here a disturbing thought intrudes. Since women have gone in for knickies and bobs and gubernatorial authority, it is conceivable that whiskers may in time have to serve again, as they served originally, to show that men are men.

The horror of such a possibility becomes evident when we see how the well-groomed man of today would look with such whiskers as were fashionable sixty years ago.

A clean shave daily makes a wonderful difference for the better. It has become a business, as well as a social requirement.



### TODAY—

Colgate's Rapid-Shave Cream makes a wonderful lather for easy and comfortable shaving.

It emulsifies the oily coating upon each hair of the beard, permitting moisture to penetrate and soften it *at the base*, where the razor's work is done.

You will realize as soon as you try it that Colgate's gives a better shave. It leaves the face soothed and velvety.

Thousands of men are turning daily to this new comfort in shaving.



COLGATE & CO.  
Dept. R  
199 Fulton St., New York  
Please send me the trial tube of  
Colgate's Rapid-Shave Cream for  
better shaving. I enclose 4c.

Name.....

Address.....

Let us send you a trial tube of  
this marvelous cream—enough  
for 12 better shaves than you  
have ever had. Just fill out  
and mail the attached coupon,  
with 4c.

COLGATE & CO.  
Established 1806  
NEW YORK

Truth in advertising implies honesty in manufacture